Amy Rosenthal/Anchorage/URSCorp
04/27/2011 01:47 PM

To arcticAR@urscorp.com
cc
bcc
Subject Fw: Reminder: Review of NMFS Arctic EIS Chapters 1-2

----- Forwarded by Amy Rosenthal/Anchorage/URSCorp on 04/27/2011 02:47 PM -----

Curtis.Jennifer@epa.gov

04/27/2011 02:19 PM

To Candace Nachman <Candace.Nachman@noaa.gov>
cc Amy_Rosenthal@URSCorp.com, Soderlund.Dianne@epamail.epa.gov, Shaw.Hanh@epa.gov, Reichgott.Christine@epamail.epa.gov
Subject Re: Reminder: Review of NMFS Arctic EIS Chapters 1-2

Hello Candace,

Attached are EPA's comments on the preliminary draft Chapters 1 and 2 for the NMFS Arctic Seismic and Exploration EIS. Per your request, we attempted to offer specific language where we could, but unfortunately could only state certain recommendations or ask clarifying questions in comment form. We focused our review and comments primarily on the relevant sections/discussions on the "zero discharge" issue in Chapter 2, and EPA's regulatory role(s). Overall, we do have concerns because:

1. The descriptions of the Arctic GP requirements are not accurate;
2. The five waste streams Shell proposes to collect and transport/dispose in the lower 48 are just that, a proposal that hasn't happened yet, and applies only to Shell's lease blocks in Camden Bay of the Beaufort Sea;
3. The Shell proposal is independent of, and a separate agreement from, the regulatory process;
4. One company's proposal to collect and barge five waste streams does not mean it is feasible for other companies or in other areas; and
5. There is a tremendous potential for inconsistent or conflicting requirements among federal agencies.

Since EPA's estimated reissuance dates for the Beaufort and Chukchi GPs are aligned with NMFS's EIS schedule, we will need to continue to coordinate very closely moving forward. We believe that additional discussion may be needed to further clarify some of these issues.

Thank you for the opportunity to comment and offer our recommendations at this time. Please let us know of any questions you may have.

(See attached file: Arctic EIS Chapter 1 (01272011) to EPA & ANOs-EPA comments.docx)(See attached file: Chapter 2 Arctic EIS (0407) for agency review-EPA comments.docx)

_____

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From: Candace Nachman <Candace.Nachman@noaa.gov>
To: Hanh Shaw/R10/USEPA/US@EPA, Jennifer Curtis/R10/USEPA/US@EPA, Dianne Soderlund/R10/USEPA/US@EPA
Cc: Amy_Rosenthal@URSCorp.com
Date: 04/21/2011 08:29 AM
Subject: Reminder: Review of NMFS Arctic EIS Chapters 1-2

Hi,

This is just a friendly reminder to please submit your comments on the first two chapters of the Arctic EIS to me by next Friday. There are some additional details in my original email below.

Please feel free to contact me with any questions or concerns.

Thanks,
Candace

Candace Nachman wrote:

> Dear Hanh, Jennifer, and Dianne,
>
> Thank you again for our conference call the other week. I think it was very useful and helpful in guiding us in our understanding of discharges in the Arctic. You will see that we have tried to capture the points of our discussion in Chapter 2. We have decided that it is too difficult to have an alternative carried through for full analysis that deals with discharges. Instead, we have described it in the Alternatives Considered But Dismissed From Further Consideration section and then worked it into the additional mitigation measures piece of the alternatives that are carried forward for full analysis. We would like to focus on those discharges that have been linked to potential impacts on marine mammals and their habitat. It would be very helpful to us if you provided feedback on the pieces specific to discharge (along with your review of the rest of the documents).
>
> I have attached both Chapters 1 and 2 to this email for your review and comment. It would be most helpful to have your comments in track changes. Also, actual suggested track changed language or text is more helpful than comment bubbles, but please use the comment bubbles for explanation as needed. Also, I would appreciate one set of comments from the EPA.

Please submit your comments to me by Friday, April 29. I will then compile them and send to URS.

Feel free to contact me with any specific questions or concerns.

Thanks,
Candace
--
Candace Nachman
Fishery Biologist

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Arctic EIS Chapter 1 (01272011) to EPA & ANOs-EPA comments.docx


Chapter 2 Arctic EIS (0407) for agency review-EPA comments.docx

Effects of Oil and Gas Activities in the Arctic Ocean Draft EIS
Draft Chapter 2 – Alternatives

2.1 Introduction

The Council on Environmental Quality (CEQ) is responsible for the development and oversight of regulations and procedures implementing the National Environmental Policy Act (NEPA). The CEQ regulations provide guidance for Federal agencies regarding NEPA's requirements (40 CFR Part 1500). The National Oceanic and Atmospheric Administration (NOAA) has also prepared environmental review procedures for implementing NEPA (NAO 216-6). The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) NEPA procedures can be found at: http://www.doi.gov/oepc/nepafr.html and the DOI Department Manual at: http://elips.doi.gov/app_dm/index.cfm?fuseaction=home.

This chapter describes the range of potential alternatives evaluated and those determined reasonable to meet the purpose and need of the proposed action as described in Chapter 1. These alternatives include the No Action alternative (no issuance of geological and geophysical (G&G) permits by the BOEMRE under the Outer Continental Shelf (OCS) Lands Act and no marine mammal take authorizations incidental to oil and gas exploration and exploratory drilling activities) and four action alternatives that would allow G&G permits and ancillary activities under the OCS Lands Act and marine mammal take authorizations under the Marine Mammal Protection Act (MMPA) associated with a range of oil and gas exploration and exploratory drilling activities.

2.2 Scoping Issues Considered in Developing the Alternatives

The first step in preparing an environmental impact statement (EIS) is publishing a Notice of Intent (NOI) in the Federal Register (FR). On February 8, 2010, the NOI announcing the preparation of this EIS was published (75 FR 6175), requesting public participation in the scoping process for 60 days. The public comment period ended on April 9, 2010. In addition to providing background information on the purpose of issuing MMPA authorizations for incidental take of marine mammals, the NOI provided a list of issues on which NOAA's National Marine Fisheries Service (NMFS) was seeking public input. These issues included:

- Protection of subsistence resources and Inupiat culture and way of life;
- Disturbance to bowhead whale migration patterns;
- Impacts of seismic operations on marine fish reproduction, growth, and development;
- Harassment and potential harm of wildlife, including marine mammals and marine birds, by vessel operations, movements, and noise;
- Impacts on water quality;
- Changes in the socioeconomic environment;
- Impacts to threatened and endangered species;
- Impacts to marine mammals, including disturbance and changes in behavior;
- Incorporation of traditional knowledge in the decision-making process; and
- Efficacy and feasibility of marine mammal monitoring and other mitigation and monitoring measures.

Public scoping meetings were held in all of the coastal Alaskan communities affected by the proposed action, as well as Anchorage, on the following dates:

- Kotzebue – February 18, 2010
- Point Hope – February 19, 2010
- Point Lay – February 22, 2010
- Wainwright – March 9, 2010
- Barrow – March 10, 2010
- Nuiqsut – March 11, 2010
- Kaktovik – March 12, 2010
- Anchorage – March 23, 2010

In a separate but parallel process for government-to-government consultation, federally-recognized Tribal governments in each community, with the exception of Anchorage, were notified of the EIS process and invited to participate. The first contact was via letter, dated January 29, 2010; follow-up calls were made with the potentially affected Tribal governments, and each entity was visited during the scoping process. The Scoping Comment Analysis Report (CAR) (Appendix XX) includes comments received in the scoping period during government-to-government consultation between NMFS, BOEMRE, and the Tribal governments.

Table 2-1 presents a summary of the substantive comments about alternatives and mitigation measures NMFS may require in their incidental take authorizations (ITAs) that were raised during public scoping meetings and submitted to NMFS during the public comment period. A more complete presentation of formal comments is included in Appendix XX.

Table 2-1. Summary of the Substantive Comments on the Alternative Development Process Received During Scoping

Category	Comment
No Action Alternative	NMFS should explain why it is including a No Action Alternative because that option is not within the authority of the agency to enforce.
	There are significant economic consequences to the No Action Alternative that need to be analyzed, including importing oil from foreign nations.
Flexibility in Managing and Authorizing Seismic and Exploratory Activities	NMFS should consider a sufficient range of alternatives to provide for maximum flexibility in determining the final course of action pursuant to the purpose and need statement.
	The alternatives should treat the Chukchi and Beaufort Seas separately and adopt a flexible program with realistic operating scenarios.
	The alternatives should adopt a flexible approach to the various seismic and drilling activities taking place within a defined area and evaluate the impacts of proposed operations on an annual basis
	NMFS should consider a broader range of exploration scenarios, given that industry estimates are not always reflective of actual activity into the future
	Alternatives that consider five-year permits should provide for notice and public comment on an annual basis, particularly with concern to subsistence users.
	Establish a cap to limit the total number of oil and gas activities that may occur in a planning area on a per season basis.
	Arbitrary restrictions on concurrent operations could undermine a lessee's ability to explore its leases.
	Because BOEMRE regulations (30 CFR Part 251) state that G&G activities cannot create or cause hazardous or unsafe conditions, any mitigation and monitoring measures imposed on seismic surveys by NMFS and BOEMRE must not result in hazardous or unsafe conditions
Protection of Sensitive Areas	Areas of high ecological or biological significance should be protected with seasonal restrictions on the types of activities that can occur there. Specific areas suggested include: ◊ Critical feeding and resting grounds near Camden Bay in the mid-Beaufort Sea; ◊ Critical feeding grounds in the eastern Alaskan Beaufort Sea and near Barrow Canyon in the western Beaufort Sea; ◊ Nearshore areas (within 50 miles of the coast); ◊ Areas that are important for denning, feeding, and/or migration for Arctic marine mammal species such as Pacific walrus, bowhead whales, beluga whales, or polar bears; and ◊ Ledyard Bay critical habitat area for spectacled eiders.
	Subsistence use areas should also be protected with seasonal restrictions on the types of activities that can occur there, such as: ◊ Areas used by the Village of Kaktovik in the eastern Beaufort Sea; ◊ Areas around Cross Island used by the Village of Nuiqsut; ◊ Areas used by the Village of Barrow in the western Beaufort Sea; ◊ Areas used by Wainwright and Point Lay along the Chukchi Sea coast; and Kotzebue Sound (through July 10). ◊ Proposed access routes should be surveyed for ice seal lairs, breathing holes, and resting locales to avoid disturbance of these animals

Category	Comment
Monitoring and Mitigation Measures	NMFS should not issue ITAs unless they can ensure that mitigation measures will remove the potential for serious injuries or mortality to marine mammals from activities associated with oil and gas operations
	The proposed EIS should consider alternatives that address shortcomings in monitoring and mitigation measures
	The EIS should include a list of Conflict Avoidance Agreements for all Native groups in Alaska and adopt similar requirements to minimize impacts on subsistence hunting activities
	Required mitigation measures, specifically safety and exclusion zones, should be adaptive and based on sound research and must be reasonable and feasible. Specific suggestions include: ◊ Exclusion zones and other regulatory threshold criteria for the implementation of mitigation measures (e.g. 180/190 dB safety and exclusion zones) should be adjusted upwards to 230 dB re:1 uPa (peak, flat) for cetaceans and 218 dB re:1 uPa (peak, flat) for pinnipeds. ◊ NMFS should use the noise exposure criteria proposed in Southall et al. (2007) to determine the thresholds for sound exposure and exclusion zones for marine mammals during seismic surveys
	Marine mammal monitoring should be required for oil and gas activities. Technologies and methods suggested include: ◊ Acoustic recorders; ◊ Aerial monitoring; ◊ Satellite tagging; and ◊ On-board marine mammal observers
	A sound cap or budget that limits the total amount of noise allowed per season should be considered as a mitigation measure.
	Safety and exclusion zone distances should be calculated based on peak levels of sound generated by the oil and gas equipment
	Mitigation measures are needed to minimize or avoid ship strikes of marine mammals. Suggested measures include: ◊ Designating specific shipping lanes; ◊ Implementing seasonal restrictions to protect marine mammals during their migration; and ◊ Establishing speed restrictions
	Require the use of fish finding equipment and procedures to shut down seismic activity when large schools of fish are encountered
Best Available Technology for Exploratory Activities	The best available technology should be used to minimize impacts. Specific suggestions include: ◊ Vibroseis; ◊ Extended reach drilling; ◊ Zero discharge technology (as implemented in Norway); ◊ Gravity, magnetic, and gravity gradiometry data collection; and ◊ Low-sulfur fuel.

2.3 Oil and Gas Exploration Activities Covered in the Alternatives

2.3.1 BOEMRE Process for Permitting

In addition to applying for an ITA from NMFS, industry applicants will also work closely with federal and state agencies to obtain other permits. In particular, the permits and authorizations required by BOEMRE affect the progression of exploration activities. It is important to understand this progression of activities as they are approved and permitted, as it can help explain the timing, stages, and sequence of exploration for offshore oil and gas resources. The following summarizes these processes, as it pertains to a description of these types of exploratory activities:

- **Geological & Geophysical (G&G) Exploration Permits –** In accordance with 30 CFR 251, a permit must be obtained from BOEMRE prior to conducting geological or geophysical exploration on unleased lands or on lands under lease by a third party (someone other than BOEMRE or the applicant). On-lease G&G exploration can be conducted under a G&G permit or an Ancillary Notice in accordance with 30 CFR 250.
- **Ancillary Activities –** These on-lease activities include shallow hazards and site clearing surveys, two-dimensional (2D) and three-dimensional (3D) deep penetration seismic, and geotechnical drilling. Ancillary activities are conducted in accordance with 30 CFR 250.
- **Application for Permit to Drill (APD)** – a permit must be obtained prior to conducting drilling operations and requires detailed information on the seafloor and shallow seafloor conditions for the drill site from shallow geophysical surveys. An exploration plan (EP) is submitted with this APD. An EP is not required with a G&G or ancillary activities permit.

Because of the permitting process listed above, there is a general progression of oil and gas exploration and drilling activities. This progression will determine how many concurrent activities will be applied for on an annual basis and will vary by year and the success of the previous activity:

- Either pre-lease or post-lease, companies will conduct 2D or 3D deep penetration seismic surveys to identify areas of interest. Gravity, magnetic, and electromagnetic surveys may also be conducted. The collection of this information is generally used for industry to gather information on potential hydrocarbon resources in advance of a lease sale. Further, industry must provide BOEMRE with data and results from these surveys. BOEMRE in turn uses these data to determine the fair market value of a potential lease block for the lease sale.
- After obtaining a lease, companies will conduct high-resolution geophysical seismic surveys (also called “site clearance” or “shallow hazard surveys”) to identify depth to seafloor, topography, potential shallow faults or gas zones, presence of archaeological features, and depth and distribution of ice gouges in the seabed. These surveys are required by BOEMRE as part of the lease conditions to ensure, among many things, that structures are not placed on shallow gas reserves or historical finds.
- Based on data from the 2D/3D and high-resolution seismic surveys, companies will propose to drill several test wells in the area of interest. The type of drilling rig used

depends on water depth, sea ice conditions, ice-resistance of the rigs, and availability of units.

All of these operations require some form of additional support, such as crew change vessels, fuel barges, aircraft, and staging areas. Therefore, the description of each activity in the following sections will identify the associated typical support operations. Table 2.2 summarizes the associated support vessels and operations with each activity.

Table 2.2. Summary of Support Operations for Seismic Exploration Activities

Comment [ACR1]: BOEMRE – confirm support operations vessels and numbers

Activity	Support Operations
Marine streamer 2D and 3D surveys	• 1 source/receiver vessel • 1 support vessel • Likely 1 vessel for monitoring
Multi-azimuth seismic survey (multiple passes in different directions with one source/receiver vessel)	• 1 source /receiver vessel • 1 support vessel • Likely 1 vessel for monitoring
Wide-azimuth seismic survey (multiple passes with multiple source vessels and at least one receiver vessel	• 2 to 4 source vessels • 1 to 2 receiver vessels • 1 support vessel • 1 vessel for monitoring
Rich-azimuth seismic survey (multiple passes with multiple source vessels and at least 1 receiver vessel)	• 2 to 4 source vessels • 1 to 2 receiver vessels • 1 support vessel • 1 vessel for monitoring
Full-azimuth coil-pattern seismic survey (single source/receiver vessel)	• 1 source/receiver vessel • 1 support vessel • Likely 1 vessel for monitoring
In-ice seismic survey	• 1 source/receiver vessel • 1 icebreaker • Possible 1 support vessel
Ocean-bottom cable surveys	• 2 vessels for cable layout/pickup • 1 recording vessel • 1 to 2 source vessels • 1 to 2 small support vessels
High-resolution surveys airguns	• 1 source/receiver vessel • Possible 1 vessel for monitoring
High-resolution surveys sonars	• 1 source vessel
On ice vibroseis	• Truck-mounted vibrators over ice • No vessels
Electromagnetic surveys	• 1 to 2 vessels for receivers layout/pickup • 1 source vessel • 1 small support vessel

Activity	Support Operations
Artificial island drilling	• Drilling on island • Multiple small support vessels • Aircraft for crew changes
Steel-drilling caisson drilling	• Modified very large crude carrier vessel • 2-3 tugs and supply to and from drillsite
Exploratory Drilling Program from a Drillship	• Drillship • 1 or 2 icebreakers • 1 anchor handler • 1 or 2 oil spill response barge and tug • Tank vessel for spill storage • 2-3 support vessels
Exploratory Drilling Program from a Jackup rig	• Jackup rig • 1 or 2 icebreakers • 1 or 2 oil spill response barge and tug • Tank vessel for spill storage • 2-3 support vessels

2.3.2 Overview of Commercially-Available Geophysical Survey Methods

Background

Seismic exploration is the search for commercially and economically valuable subsurface deposits of crude oil, natural gas, and minerals. Recording, processing, and interpreting reflected seismic waves, created by introducing controlled source energy (such as seismic airgun impulses, sonar signals, and vibratory waves) into the earth, provides a means to develop geological models to aid in resource evaluation.

Seismic surveys, most often characterized by the type of data being collected (e.g. 2D, 3D, high-resolution), may also be described in very general terms by when the surveys occur, such as off-lease or entirely on-lease. Survey data may be described by the acoustic sound source (e.g. airgun, water gun, sparker, pinger) or by the purpose for which the data are being collected (e.g. speculative shoot, exclusive shoot, site clearance).

Seismic surveys may also be described by the configuration of the survey and/or the location of the receivers. Vertical seismic profiling and vertical cable surveys both use standard seismic sources and do not need to be discussed separately from standard seismic surveys. These types of surveys have rarely or never been used in the Alaskan OCS to date and, therefore, will not be considered in the analysis in this EIS. Multi-azimuth and full-azimuth coil pattern surveys also use a standard source and single source/receiver vessel. A wide-azimuth survey consists of multiple source vessels and at least one receiver vessel; a rich-azimuth survey incorporates the multiple source vessel survey with a multi-azimuth survey configuration. None of the azimuth style surveys have been performed in the Arctic OCS to date, but are common in the rest of the world.

The most commonly used marine energy sources are airguns which emit highly compressed air bubbles that transmit acoustic energy though the water column into the subsurface. Seismic waves reflect and refract off subsurface rock formations and travel back to acoustic receivers

called hydrophones. Streamers are the passive listening equipment, consisting of multiple hydrophone elements, which are towed behind the vessel. The characteristics of the reflected seismic waves (such as travel time and intensity) are used to evaluate geologic structures, subsurface deposits, and natural resources to help facilitate the location of prospective drilling targets and provide the information for a company to determine their bidding strategy for an OCS lease sale.

An individual airgun size can range from five to 1,500 cubic inches (in^3) (0.081 to 24.58 liters). A combination of airguns is called an array; operators vary the source-array size to optimize the resolution of the geophysical data collected. Airgun array sizes for 2D/3D deep penetration seismic surveys in the Arctic Seas are expected to range from 1,800-5,000 in^3 (29.50 to 81.94 liters) but may range up to 6,000 in^3 (98.32 liters). Appendix XX provides details on the acoustic characteristics of each of these exploration methods, including source levels, frequency, propagation, and the effect of environmental factors on these characteristics. However, in general, broadband peak source levels of a typical full-scale array range from 248-255 dB re 1 µPa at 1 m with most of the energy emitted between 10 and 120 Hz, although pulses may contain energy up to 1000 Hz (Richardson et al. 1995).

Marine Deep Penetration Towed-Streamer 3D and 2D Surveys

Marine deep penetration towed-streamer 3D seismic surveys vary markedly depending on client specifications, subsurface geology, water depth, and target reservoir(s). Individual survey parameters may vary from the descriptions presented here. The vessels conducting these surveys generally are 70-120 meters (m) (230-394 feet [ft]) long. Vessels tow one to three source arrays, of six to nine airguns each, depending on the survey design specifications required for the geologic target. Most operations use a single source vessel. However, more than one source vessel will be used in wide or rich azimuth surveys or when using smaller vessels, which cannot provide a large enough platform for the total seismic gun array necessary to obtain target depth. The overall energy output for the permitted activity will be the same, but the firing of the source arrays on the individual vessels will be alternated.

Vessel transit speeds are highly variable, ranging from 8-20 knots (kn) (14.8 to 37.0 kilometers [km]/hour) depending on a number of factors including, but not limited to, the vessel itself, sea state, urgency (the need to run at top speed versus normal cruising speed), and ice conditions. Marine 3D surveys are acquired at typical vessel speeds of approximately 4.5 kn (8.3 km/hour).

The source array is triggered approximately every 10-15 seconds (s), depending on vessel speed. The timing between shots varies and is determined by the spacing required to meet the geological objectives of the survey; typical spacing is either 25 or 37.5 m (82 or 123 ft), but may vary depending on the design and objectives of the survey. Airguns can be fired between 20 and 70 times per km. Modern marine-seismic vessels tow up to 20 streamers with an equipment-tow width of up to approximately 1,500 m (4921 ft) between outermost streamers. Biodegradable liquid paraffin is used to fill the streamer and provide buoyancy. Solid/gel streamers also are available for use and are rapidly becoming the industry standard.

The 3D survey data are acquired along pre-plotted tracklines within a specific, permitted, survey area. Adjacent tracklines for a 3D survey are generally spaced parallel to each other several hundred meters apart. The areal extent of the equipment limits both the turning speed and the area a vessel covers. It is, therefore, common practice to acquire data using an offset racetrack

pattern, whereby the next acquisition line is several km away from, and traversed in the opposite direction of, the track line just completed. Seismic vessels operate day and night, and a survey may continue for days, weeks, or months, depending on the size of the survey, data-acquisition capabilities of the vessel, and weather or ice conditions. Vessel operation time includes not only data collection, but also deployment and retrieval of gear, line turns between survey lines, equipment repair, and other planned or unplanned operations.

The 2D and 3D surveys use similar survey methods but different operational configurations. Three dimensional survey lines are spaced closer together and are concentrated in a specific area of interest. These surveys provide the resolution needed for detailed geological evaluation. A 2D survey provides less detailed geological information because the survey lines are spaced farther apart. These surveys are used to cover wider areas to map geologic structures on a regional scale.

The 2D seismic survey vessels generally are smaller than 3D survey vessels; larger 3D survey vessels are also able to conduct 2D surveys. The source array typically consists of three or more sub-arrays of six to eight airgun sources each, but may vary as newer technology is developed. Only one streamer is towed during 2D operations. Figure 2.1 illustrates a typical 2D marine towed-streamer seismic survey.

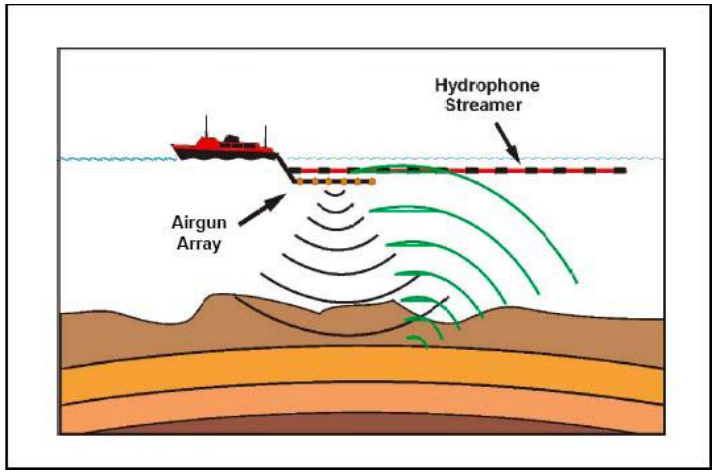

Figure 2.1. Simple Illustration of a Marine Seismic Survey Operation using Streamers Source: USDOI, MMS, Alaska OCS Region

Seismic vessels acquiring 2D data are able to acquire data at four to five kn (7.4 to 9.3 km/hour), 24 hours a day, and collect between 85-110 line-miles (137 to 177 line-km) per day, depending on the distance between line changes, weather conditions, and downtime for equipment problems. Typically, a survey vessel can collect 5,000-8,000 line-miles (8,047 to 12,875 line-km) during an open water seismic operational season in Arctic waters.

At least one support vessel would be used for safety considerations, general support, maintenance, and resupply of the main vessel, but it would not be directly involved with the collection of seismic data. Crew changes, refueling, and resupply for the seismic vessels are generally on a four to six week schedule. Helicopters, when available, also may be used for

vessel support and crew changes, if there are no safety concerns. An additional support vessel may be used to monitor for marine mammals ahead of the survey vessel.

In-Ice Towed-Streamer 2D Surveys

A change in technology has allowed geophysical (seismic reflection and refraction) surveys to be conducted in thicker sea ice concentrations. Sea ice concentration is defined in terms of percent coverage in tenths. An area with 1/10 coverage of ice means the area contains sporadic ice floes that provides for easy vessel navigation; whereas, 10/10 coverage of ice means there is no open water in the area. This new technology uses a 2D seismic source vessel and an Arctic-class icebreaker. The icebreaker generally operates ~0.5–1 km (~0.3-0.62 miles [mi]) ahead of the seismic acquisition vessel, which follows at speeds ranging from 4 to 5 kn (7.4 to 9.3 km/hour). Like open-water 2D surveys, in-ice surveys operate 24 hours a day or as conditions permit. A third vessel is used for one or more short support trips as conditions allow during the length of the survey.

The only in-ice seismic system currently operational consists of two sub-arrays comprised of 14 airguns each. Individual airgun sizes range from 65 to 350 in^3 (1.1 to 5.7 liters) with a total volume of 4,330 in^3 (71.0 liters). The sub-arrays are towed between 25 and 50 m (82 and 164 ft) behind the source vessel, depending on the conditions, at a water depth of about 8.5 m (28 ft). The airgun array discharges every 50 m (164 ft) or about every 20 seconds.

A single hydrophone streamer, which uses a solid fill material to produce constant and consistent streamer buoyancy, is towed behind the vessel. The streamer, which is about 8.5 km (5.2 mi) long and towed about 9.5 m (31.2 ft) below the water surface, receives the reflected signals from the subsurface and transfers the data to an on-board processing system. Approximately every 300 m (984 ft) along the streamer, a device is attached to maintain the desired deployment depth and lateral control. The survey vessel has limited maneuverability while towing the streamer and thus requires a 10 km (6.2 mi) run-in for the start of a seismic line, and a 4-5 km (2.5-3.1 mi) run-out at the end of the line.

Ocean-Bottom-Cable Seismic Surveys

Ocean-bottom-cable (OBC) seismic surveys are used in Alaska primarily to acquire seismic data in transitional zones where water is too shallow for a seismic survey vessel and too deep to have grounded ice in the winter. The OBC seismic survey requires the use of multiple vessels. A typical survey includes: (a) two vessels for cable layout/pickup; (b) one vessel for recording; (c) one or two source vessels; and (d) possibly one or two smaller utility boats.

Most operations use a single source vessel, but multiple source vessels may be used if size prohibits loading the full airgun array required for the survey on one vessel. The overall energy output for the permitted activity would be the same for a two vessel shoot, as the source arrays alternate vessels when firing. These vessels are generally, but not necessarily, smaller than those used in towed-streamer operations. OBC seismic arrays are frequently smaller in size than the towed marine streamer arrays due to the shallower water depths in which OBC surveys are usually conducted. The utility boats can be small, in the range of 10-15 m (33-49 ft).

An OBC operation begins by laying cables off the back of the layout boat. Cable length typically is 4-6 km (2.5-3.7 mi) but can be up to 12 km (7.5 mi). Groups of seismic-survey receivers (usually a combination of both hydrophones and vertical-motion geophones) are attached to the

cable in intervals of 12-50 m (39-164 ft). Multiple cables are laid on the seafloor parallel to each other using this layout method, with a cable spacing of between hundreds of meters to several kilometers, depending on the geophysical objective of the seismic survey. When the cable is in place, a vessel towing the source array passes over the cables with the source being activated every 25 m (82 ft). The source array may be a single or dual array of multiple airguns, which is similar to the 3D marine seismic survey. Figure 2.2 illustrates an OBC operation.

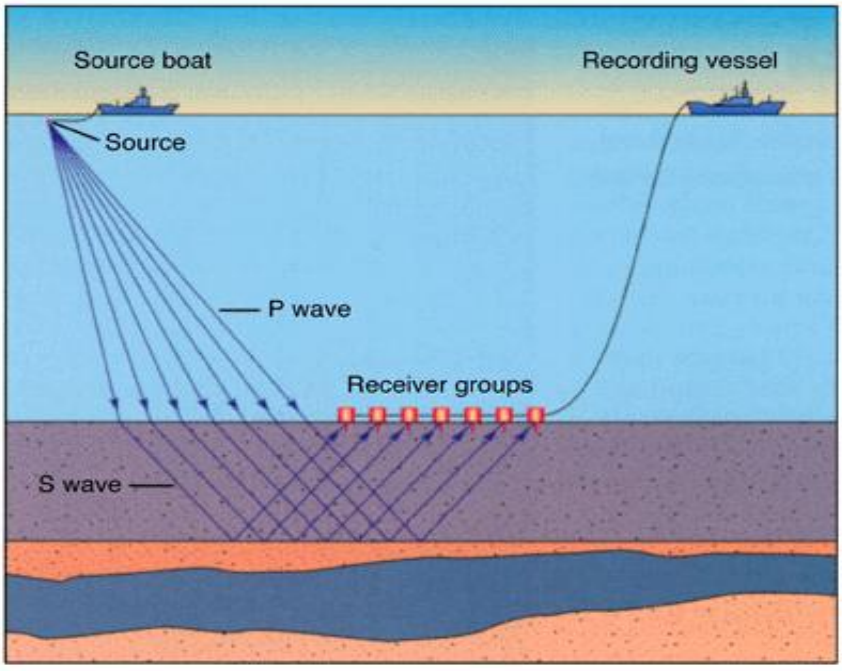

Figure 2.2. Illustration of Ocean Bottom Cable survey. Source: Schlumberger website.

After a trackline (i.e., pre-determined line along which the source vessel travels at a constant speed to effectively transmit sound to the bottom in a manner that allows for predictable receipt of acustic reflections at the receiver cable) is completed, the source ship takes about 10-15 minutes to turn around and pass over the next cable. When a cable is no longer needed to record seismic survey data, it is recovered by the cable-pickup ship and moved to the next recording position. A particular cable can lay on the seafloor anywhere from two hours to several days, depending on operation conditions. Normally, a cable is left in place for about 24 hours.

An OBC seismic survey typically covers a smaller area (approximately 16 by 32 km [10 by 20 mi]) and may spend days in an area. In contrast, 3D towed-streamer seismic surveys cover a much larger area (thousands of square miles) and stay in a particular area for hours. While OBC seismic surveys could occur in the nearshore shallow waters of the Beaufort Sea, they are not anticipated to occur in the Chukchi Sea OCS because of its greater water depths and the exclusion of the near shore OCS area from leasing. Recent technological developments have been introduced that provide improved operational flexibility for equipment deployment,

recovery, and data collection in the field, but the costs are high compared to streamer-collected data.

High-Resolution Shallow Hazards Geophysical Surveys

Prior to submitting an exploration or development plan, oil and gas industry operators are required to evaluate any potential geological hazards and document any potential cultural resources or benthic communities pursuant to 30 CFR 250. The BOEMRE has provided guidelines (Notices to Lessees 05-A01, 05-A02, and 05-A03) that require high-resolution shallow hazards surveys to ensure safe conduct and operations in the OCS at drill sites and along pipeline corridors, unless the operator can demonstrate there is enough data to evaluate the site.

The suite of equipment used during a typical shallow hazards survey consists of: single beam and multibeam echosounders which provide water depths and seafloor morphology; a side scan sonar that provides acoustic images of the seafloor; a subbottom profiler which provides 20-200 m (66-656 ft) sub-seafloor penetration with a 6-20 cm (2.4-7.9 inches [in]) resolution; a bubble pulser or boomer with 40-600 m (131-1,969 ft) sub-seafloor penetration; and a multichannel seismic system with 1,000-2,000 m (3,280-6,562 ft) sub-seafloor penetration. Magnetometers, that detect ferrous items, have not been required in the Alaska OCS to date. Typical acoustic characteristics of these sources are summarized in Richardson et al. (1995) as following:

- Echosounders: 180-200 dB re 1 µPa at 1 m between 12 and 60 kHz
- Side scan sonar: 220-230 dB re 1 µPa at 1 m between 50 and 500 kHz
- Subbottom profiler: 200-230 dB re 1 µPa at 1 m between 400 Hz and 30 kHz
- Bubble pulser or boomer: 200 dB re 1 µPa at 1 m below 1 kHz

The echosounders and subbottom profilers are generally hull-mounted. All other equipment is usually towed behind the vessel. The multichannel seismic system consists of an acoustic source which may be a single small airgun 10 to 65 in^3 (0.16 to 1.1 liters) or an array of small airguns usually two or four 10 in^3 (0.16 liter) guns. The source array is towed about 3 m (9.8 ft) behind the vessel with a firing interval of approximately 12.5 m (41 ft) or every 7-8 s. A single 300-600 m (984-1,969 ft), 12-48 channel streamer with a 12.5 m (41 ft) hydrophone spacing and tail buoy is the passive receiver for the reflected seismic waves.

The ship travels at 3-4.5 kn (5.6-8.3 km/hour). These survey ships are designed to reduce vessel noise, as the higher frequencies used in high-resolution work are easily masked by the vessel noise if special attention is not paid to keeping the ships quiet. Surveys are site specific and can cover less than one lease block, but the survey extent is determined by the number of potential drill sites in an area. BOEMRE regulations require data to be gathered on a 150 by 300 m (492 by 984 ft) grid within 600 m (1,969 ft) of the drill site, a 300 by 600 m (984-1,969 ft) grid out to 1,200 m (3,937 ft) from the drill site, and a 1,200 by 100 m (3,937 by 328 ft) grid out to 2,400 m (7,874 ft) from the well site.

A single vertical well site survey will collect about 46 line-miles (74 line-km) of data per site and take approximately 24 hours. If there is a high probability of archeological resources, the 150 by 300 m (492 by 984 ft) grid must extend to 1,200 m (3,937 ft) from the drill site.

On-Ice Winter Vibroseis Seismic Surveys (also referred to as over-ice or hard water surveys)

Winter vibroseis seismic operations use truck-mounted vibrators that systematically put variable frequency energy through the ice and into the seafloor. At least 1.2 m (3.9 ft) of sea ice is required to support heavy vehicles used to transport equipment offshore for exploration activities. These ice conditions vary, but generally exist from sometime in January until sometime in May in the Arctic. The exploration techniques are most commonly used on landfast ice (ice attached to the shoreline), but they can be used in areas of stable offshore pack ice near shore. Several vehicles are normally associated with a typical vibroseis operation. One or two vehicles with survey crews move ahead of the operation and mark the source receiver points. Occasionally, bulldozers are needed to build snow ramps to smooth offshore rough ice within the survey area.

With the vibroseis technique, activity on the surveyed seismic line begins with the placement of geophones (receivers). All geophones are connected to the recording vehicle by multi-pair cable sections. The vibrators move to the beginning of the line and recording begins. The vibrators move along a source line, which is at some distance or angle to a receiver line. The vibrators begin vibrating in synchrony via a simultaneous radio signal to all vehicles.

In a typical survey, each vibrator will vibrate four times at each location. The entire formation of vibrators subsequently moves forward to the next energy input point (e.g., approximately 67 m [220 ft] in most applications) and repeats the process. Most energy is beamed downward. In a typical 16- to 18-hour day, a survey will complete 3 6 to 16 linear km (3.7 to 9.9 mi) in a 2D seismic survey, and 24 to 64 linear km (15 to 40 mi) in a 3D seismic survey. Vibroseis signals typically sweep from 10 to 70 Hz at an estimated source level of 187 dB re 1 µPa at 1 m (Richardson et al. 1995).

Controlled Source Electromagnetic Survey

Measurements of electrical resistivity beneath the seafloor have been used in oil and gas exploration, but historically have been collected through the wire-logging of wells. Since 2002, several electromagnetic methods have been developed for mapping sub-seafloor resistivity, including marine controlled source electromagnetic (CSEM) sounding (Eidesmo et al. 2002). This method uses a mobile horizontal electric dipole source and an array of seafloor electric receivers. The transmitting dipole emits a low frequency (typically 0.5 to 10 Hertz [Hz]) electromagnetic signal into the water column into the underlying sediments. Electromagnetic energy is attenuated in the conductive sediments, but in higher resistive layers (such as hydrocarbon-filled reservoirs), the energy is less attenuated. This contrast is what is detected to provide data on potential areas of interest.

The length of the dipole varies between 10-50 m (33-164 ft) and the system is towed at approximately 24-40 m (79-131 ft) above the seafloor at a speed of 5 km/hr (3.1 mi/hr). Figure 2.3 illustrates a CSEM survey.

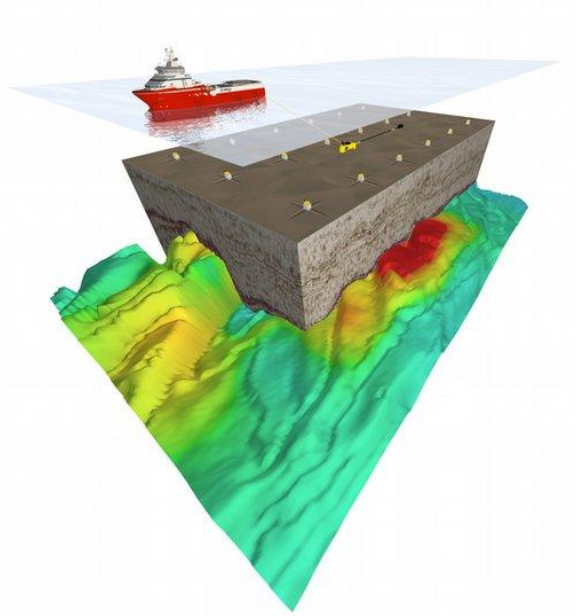

Figure 2.3. Schematic view of a Controlled Source Electromagnetic (CSEM) survey. A horizontal electric dipole is towed above receivers that are deployed on the seafloor. Source: 2010 Electromagnetic Geoservices ASA

Gravity and Gradiometry Surveys

Gravity surveys have been used for years in the oil and gas industry. Measurements taken at the Earth's surface express the acceleration of gravity of the total mass of the Earth. State of the art gravity meters can sense differences in the acceleration (pull) of gravity to one part in one billion. Because of their high sensitivity, these instruments can detect mass variations in the crustal geology, possible indicators of fault displacement and geologic structures favorable to hydrocarbon production.

In 1994, the U.S. Defense Department declassified the 3D full tensor gradiometer. This allowed the gravity field gradient to be determined by using accelerometers to measure the spatial multi-components of gravity. The equipment utilized for gradiometry surveys is much more complex than that of traditional gravity surveys. The new gravity data are evaluated in three dimensions instead of the two dimensions in traditional gravity surveys and can better define subsurface bodies of varying densities.

The increase in data resolution provided by the new technology has allowed the geology below salt to successfully be imaged in the Gulf of Mexico. This technology could be used in the Arctic Seas as a method for identifying features such as basins and edges, but would not replace 3D seismic.

2.3.3 Exploratory Drilling

Exploratory drilling activities conducted on the OCS must be conducted in accordance with BOEMRE regulations (30 CFR 250). These regulations set comprehensive requirements for well design based on site specific shallow geohazards site clearance information and deep seismic data, redundant pollution prevention equipment, testing and verification that equipment is working properly, and training and testing of personnel in well control procedures. These regulations also establish requirements on the technical specifications for the specific drilling rig and the drilling unit.

No drilling activity can be conducted until the BOEMRE has approved an APD. BOEMRE engineers and geoscientists review each APD for proper engineering considerations, site specific engineering and geologic conditions, and compliance with BOEMRE regulations. Any changes to an approved APD must be submitted, reviewed, and approved by the BOEMRE.

There are currently three principal forms of exploratory drilling platforms used in offshore exploration: artificial or natural islands; bottom-founded structures; and floating vessels. For the purposes of this study, based on reasonably foreseeable activities in the Arctic, islands and floating vessels (i.e., drillships and jackup rigs) will be discussed in detail.

Exploratory wells are generally drilled vertically to simplify well design and maximize benefits from subsurface data collection (i.e. well logs, cores). Directional wells (any well that is not vertical) may be drilled if a suitable surface location cannot be used or if there is a subsurface anomaly that should be avoided. BOEMRE considers a well to be directional when the inclination of the well bore path is over three degrees from vertical. Directional drilling is different than extended reach drilling (ERD). ERD is a term used for wells drilled with significant horizontal departures from the surface location; on the order of several km (10,000s of feet). ERD is an evolving technology for production wells but currently is not used for exploration.

Artificial Islands

Artificial islands are constructed in shallow offshore waters for use as drilling platforms. In the Arctic, artificial islands have been constructed from a combination of gravel, boulders, artificial structures (e.g., caissons which are watertight retaining structures), and/or ice. Artificial islands can be constructed at various times of the year. During summer, gravel is removed from the seafloor or onshore sites and barged to the proposed site and deposited to form the island. In the winter, gravel is transported over ice roads from an onshore site to the island site. After the artificial island is constructed to its full size, slope protection systems are installed, as appropriate for local oceanographic conditions, to reduce ice ride-up and erosion of the island. Once the island is complete, a drilling rig is transported to the island. On average, approximately 100 people operate a typical rig site. Due to economic and engineering considerations, gravel island construction has historically been restricted to waters less than 15 m (49 ft) deep. It is anticipated that artificial islands could be constructed in the Beaufort Sea but not in the Chukchi Sea.

Comment [JCurtis2]: Would it be appropriate to discuss the regulation of material for construction of islands (404 or MPRSA)?

Caisson-Retained Island

Caisson-retained islands are similar in construction and design to other artificial islands with one significant exception. Rather than relying entirely on gravel or large boulders for support, the

island contains one or more floatable concrete or steel caissons, which rest on an underwater gravel berm or on the ocean floor in water less than 6 m (19.7 ft) deep. The berm is constructed with dredged or deposited material to within 6 m (19.7 ft) of the sea surface. When each caisson is in place, the resulting concrete or steel ring is filled with sand to give the structure stability. This design, like the gravel island, allows drilling to occur all year. When drilling is completed, the center core of sand can be dredged out, the caissons refloated, and the structure moved to a new location. The berm is left to erode by the natural action of the ocean

Steel Drilling Caisson

The Steel Drilling Caisson (SDC), a bottom-founded structure, is a "fit for purpose" drilling unit constructed typically by modifying the forward section of an ocean-going Very Large Crude Carrier. The main body of the structure is approximately 162 m (531 ft) long, 53 m (174 ft) wide, and 25 m (82 ft) high. The SDC is designed to conduct exploratory year-round drilling under arctic environmental conditions.

Figure 2.4. SDC operating in the Beaufort Sea Source: ICETECH 2010 Conference

On its first two deployments in the Canadian Beaufort, the SDC was supported by subsea gravel berms. For its third deployment in Harrison Bay in 1986, a steel component was constructed to support the SDC in lieu of the gravel berms. It was also used in 2002 by EnCana on the McCovey prospect. The steel base configuration adds 13 m (42.7 ft) to the design height of the structure and allows deployment of the SDC in water depths of 8-24 m (26-79 ft) without bottom preparation. The SDC requires minimal support during the drilling season. It is typically stocked with supplies before being moved to a drill site. Two or three tugs and/or supply vessels tow the SDC to or from the drill site during open water periods. Deployment and recovery of the SDC require less than one week each. Personnel (typically a maximum of 100) and some smaller equipment are transported to and from the SDC by helicopter. Fuel and larger items, if required, are transported by supply vessel.

The SDC is the only existing man-made bottom founded structure that could be used in the U.S. Beaufort Sea. The water depths for existing leases in the U.S. Chukchi Sea are too deep for the SDC. A Concrete Island Drilling Structure was used to drill an exploratory well in Camden Bay; however, it has been converted into a permanent development platform offshore Sakhalin, Russia and would not be available for exploratory drilling in the U.S.

Floating Drilling Vessels

Floating drilling vessels include drillships (e.g., *Northern Explorer II, Noble Discoverer*), semi-submersibles, or other floating vessels (e.g., *Kulluk*) in which the hull does not rest on the seafloor. These types of drilling vessels can typically be used in water depths greater than 18 m (59 ft) in the Beaufort and Chukchi Seas. This range makes them more suitable for the deeper water exploratory prospects than the "bottom founded" units such as the islands or the SDC mentioned in previous sections. Floating drilling vessel crews typically range from 100 to 200 people to operate the marine and drilling systems and ensure the safety of the operation (not including support or ice management vessels). These types of floating drilling vessels are held

over a well drilling location either by a mooring system (consisting of an anchor, chain, and wire rope) or by the use of dynamic positioning (omni-directional thrusters coupled with a computer control system).

Sounds generated from vessel-based drilling operations occur at low frequencies (below 600 Hz), although tones up to 1850 Hz were recorded by Greene (1987) during drilling operations in the Beaufort Sea. For the drillship *Explorer I*, sound levels of 122-125 dB re 1 Pa between 20-1000 Hz band level were measured at a range of 0.17 km (0.10 mi) (Greene 1987). Sound levels from the drillship *Explorer II* were slightly higher (134 dB) at a range of 0.20 km (0.12 mi) although tones were only recorded below 600 Hz (Greene 1987). Sounds from the *Kulluk* at 0.98 km (0.61 mi) were higher (143 dB) than from the other two vessels (Greene 1987).

Drillship

A drillship is a maritime vessel that has been equipped with a drilling apparatus. Most are built to the design specification of the company, but some are modified tanker hulls that have been equipped with a dynamic positioning system. Drillships are completely independent and some of their greatest advantages are their ability to drill in water depths of more than 2,500 m (8,202 ft) and their ability to sail between areas worldwide.

Figure 2.5. ***M/V Noble Discoverer.***

Shell Oil has proposed, in prior applications, to use the *M/V Noble Discoverer* for drilling in both the Chukchi and Beaufort Seas (Shell Incidental Harassment Authorization [IHA] application 2010). The *Discoverer* is a modern drillship, built in 1976, that has been retrofitted for operating in Arctic waters. It is a 156 m (512 ft) conventionally-moored drillship with drilling equipment on a turret. It mobilizes under its own power, so it can be moved off the drill site with help of its anchor handler. Depending on the circumstances of the situation, the procedure and time needed to move off a drill site can change. In extreme emergencies, this process can be completed in less than one hour. In the event that operations must be temporarily curtailed due to the advance detection of a hazard, the process could take from 4-12 hours. Typical transit speed of the *M/V Noble Discoverer* is 8 kn (14.8 km/hour). The vessel has full accommodations for a crew of up to 124 persons (quarters, galley and sanitation facilities). Figure 2.5 is a photograph of the *M/V Noble Discoverer*. Sounds from the *Noble Discoverer* have not yet been measured, although levels would be expected to similar to those measured for the other drillships.

Support vessels are used to assist the drillship with ice management, anchor handling, oil spill response, refueling, resupply, and servicing. The total number of support vessels depends on the local conditions and the design of the exploration program (see Table 2.2). The ice management vessels typically consist of an icebreaker and an anchor handler, as well as an auxiliary ice management vessel. The oil spill response vessels (OSRV) include an ice-capable oil spill response barge (OSRB) and associated tug, a tank vessel for storage of liquids, and smaller workboats. A re-supply ship would travel to and from the drilling site as needed. Additional vessels for marine mammal monitoring/scientific research may be used. There is also the potential for re-supply to occur via a support helicopter from the shore to the drill site, and fixed-

winged aircraft may be used for marine mammal monitoring. Unmanned aerial drones could also potentially be used for marine mammal observation and monitoring of ice conditions but would require approval from the Federal Aviation Administration (FAA).

Jackup Rig

A jackup rig is an offshore structure composed of a hull, support legs, and a lifting system that allows it to be towed to a site, lower its legs into the seabed and elevate its hull to provide a stable work deck. Because jackup rigs are supported by the seabed, they are preloaded when they first arrive at a site to simulate the maximum expected support leg load to ensure that, after they are jacked to full airgap (the maximum height above the water) and experience operating loads, the supporting soil will provide a reliable foundation. Figure 2.6 is a photograph of a jackup rig.

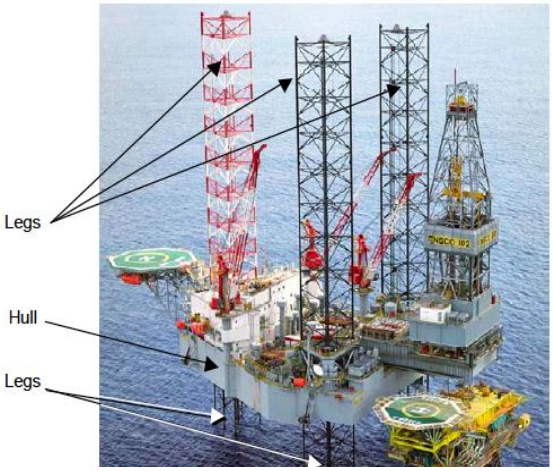

Figure 2.6. ***Jackup Rig***

There are three main components of a jackup rig: the hull; the legs and footings; and the equipment. The hull is a watertight structure that houses the equipment, systems, and personnel. When the jackup is afloat, the hull provides buoyancy and supports the weight of the legs and footings, equipment, and variable load. The legs and footings are steel structures that support the hull when elevated and provide stability to resist lateral loads. Most jackup rigs have no more than four legs. Three legs are the minimum required for stability. Units with three legs are arranged in a triangular form, while units with four legs are typically arranged in a rectangular form. Most jackup rigs in use today are equipped with rack and pinion systems for continuous jacking operations.

The actual dimensions of a jackup rig would depend on the environment in which the unit would be operating and the maximum operating water depth. A typical jack up rig with a maximum operating depth of 50 m (164 ft) is approximately 50 m (164 ft) in length, 44 m (144 ft) beam, and 7 m (23 ft) deep. ConocoPhillips has proposed in prior applications to use a jackup rig for drilling in the Chukchi Sea (ConocoPhillips air permit application 2010).

The jackup rig would have two OSRV and four workboats. One OSRV and workboat would remain within 16 km (10 mi) of the jackup rig during drilling and one OSRV would be at a distance of at least 40 km (25 mi) from the jackup rig. Two icebreakers would be in proximity of the rig and offshore supply vessels or ware vessels would be used for resupply. An anchor handling supply tug would be needed to tow the jackup rig to the site and would remain within 40 km (25 mi) of the rig for when it needs to be moved.

Noise levels from jackup rigs have not been measured, but would be similar or less than produced by the drillship discussed above. Sound levels transmitted into the water from bottom-founded structures are typically less than a drillship because the vibrating machinery is not in

direct contact with the water because the platform is above water. Noise from icebreakers would also be the same as described above.

Exploratory Drilling Activity Discharges and Emissions

Certain discharges from oil and gas exploration facilities in the Chukchi and Beaufort Seas are authorized by the U.S. Environmental Protection Agency (EPA) under the Clean Water Act Section 402, National Pollutant Discharge Elimination System (NPDES) permitting authority. ~~General Permit AKG-28-0000 (EPA 2006).~~ EPA issued the ~~The NPDES~~ Arctic NPDES General Permit, AKG-28-0000, in 2006 that authorized ~~allows for~~ discharges of wastewater from exploratory ~~both drill cuttings and used drilling fluids to ambient waters of~~operations in the Chukchi and Beaufort Seas, subject to the permit terms and conditions. ~~Drilling muds are recycled to the extent practicable based on operational considerations in order to reduce discharges. At the end of each drilling phase, the used drilling fluids are transported to another well for reuse, if feasible, or discharged into marine waters in conformance with NPDES permit conditions. At the end of the season, excess water based fluid is diluted with seawater and then discharged into marine waters in conformance with NPDES permit conditions. Other~~In addition to muds and cuttings, discharge streams may include deck drainage; sanitary wastes; domestic wastes; desalination unit wastes; blowout preventer fluid; boiler blowdown; fire control system test water; ~~-~~non-contact cooling water; uncontaminated ballast water; bilge water, excess cement slurry; and test fluids (EPA 2006)~~, all of which may be discharged after treatment according to the conditions and limitations of the NPDES General Permit~~. Oil and gas operators may request permit coverage from EPA by submitting a Notice of Intent (NOI). The Arctic NPDES General Permit expired on June 26, 2011 and EPA is in the process of reissuing the permit as two exploration general permits, one for the Beaufort Sea, and one for the Chukchi Sea. EPA expects to reissue the Beaufort and Chukchi Exploration NPDES General Permits prior to the 2012 drilling season.

Emission of air pollutants, such as nitrogen dioxide, sulfur dioxide, and carbon monoxide would be limited using best available control technology to ensure compliance with provisions of the required air quality permits and National Ambient Air Quality Standards (NAAQS) issued by the EPA.

"Zero discharge," as currently proposed by Shell Oil for specific exploratory drilling programs in Camden Bay of the Beaufort Sea, is the practice of not discharging sanitary waste, bilge and ballast water, gray water, drill cuttings with adhered drilling fluids, and water-based drilling fluids into the receiving water of Camden Bay in the Beaufort Sea once the well casing is set. Bilge, ballast, sanitary and gray water, drilling mud, and cuttings with adhered drilling mud would be stored on working ships and/or their support vessels and transported out of the Arctic Ocean and disposed of in accordance with applicable laws and regulations~~ instead of being treated and discharged into the ocean waters~~. ~~These disposal method authorizations to an onshore disposal facility would require approval by the EPA~~

Oil Spill Contingency Plans

As required by both federal and state regulations, a comprehensive Oil Discharge Prevention and Contingency Plan (ODPCP) would be implemented during exploration and drilling operations. The primary objective of an ODPCP, or "C-plan," would be to assist operators in their efforts to prevent and respond to spills. The plan would include detailed information about blowout prevention, fuel transfer procedures, equipment maintenance programs, and operating

Comment [HS3]: I am using past tense here because the Arctic NPDES general permit will expire on June 26, 2011.

Comment [JCurtis4]: (D. Soderlund) EPA utilizes general permits for exploration activities, and intends to issue individual permits for any proposed development or production

Comment [JCurtis5]: What about discussion of Phase IV APDES for state waters (Oct 31, 2012)?

Comment [JCurtis6]: Did you specifically not want to list the likely air permits that will be required in the offshore? If not, please see our April 8, 2010, scoping comments regarding EPA Regulatory Role and Environmental Effects-Air Quality. There are also state standards (AAAQS) and state airshed that may need to be considered. Currently, EPA is anticipating issuing Prevention of Significant Deterioration (PSD) permits for the Discoverer (one in the Beaufort and one in the Chukchi), a Title V permit for Conoco Phillips, and a Minor New Source permit and a Title V permit for the Kulluk, all in September 2011.

Comment [JCurtis7]: (and D. Soderlund) If this section is retained, we recommend clarification that this is voluntary and merely proposed at this time. Once implemented (or attempted), it may not prove to be feasible. In general we prefer that this discussion is left to the alternatives or mitigation discussions later in this chapter because it is really mitigation and is not relative to emissions and discharges. It could get very confusing having this description associated with federal requirements for water and air discharges, because "zero discharge" is not a regulatory term. Finally, EPA has been informed that the "zero discharge of harmful contaminants" for the Barents Sea is being revised to allow discharges.

Comment [JCurtis8]: Technically, EPA requires Facility Response Plans (FRPs) and Spill Prevention, Control and Countermeasure (SPCC) plans (40 CFR 112), not ODPCPs. My understanding is that the requirement for an ODPCP is by State of Alaska regulation. Operators have been attempting to roll all state and federal requirements into the ODPCP, but have not always been successful. A clear explanation of USCG, BOEMRE, EPA, and State requirements in this section is really important.

requirements for exploration. The ODPCP would also present analysis of potential discharges, potential areas for discharge, spill trajectory analysis, and a description of any priority protection sites. The ODPCP would include specific information on the response program, such as a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations. Specific information would be provided about procedures to stop the discharge, fire prevention and control, containment, disposal strategies. Particularly relevant to this EIS, the ODPCP would provide trajectories for the transport and disposition of potential spills, identify strategies for the protection of sensitive areas and wildlife, and would detail plans for minimizing the impact of a spill on wildlife resources and subsistence activities. Potential impacts of accidental discharges are discussed in more detail in Chapter 4.

The ODPCP would specify the dedicated response vessels and equipment provided for each activity, staging locations, and mobilization procedures for spill response assets. The spill response program would be based on the capability of responding to a range of spill volumes, from small operational spills up to and including the worst case discharge (WCD). ODPCPs must be reviewed and approved by both Federal and State regulators, including BOEMRE, the U.S. Coast Guard, and Alaska Department of Environmental Conservation (ADEC), to ensure that spill-response resources are appropriate to respond to any spill that might occur. As required by 30 CFR 254.30, ODPCPs must be reviewed at minimum every two years and resulting changes submitted to BOEMRE. If no changes are required, the applicant must submit written notification that the plan has been reviewed and that no changes are required. The applicant would be required to submit revisions of the plan to BOEMRE within 15 days of any changes that negatively impact spill response capabilities or increase the WCD scenario.

Local Community Interaction

Interaction with local communities and industry occurs in two major forms: local hire assist with observation and communication, and cooperation and conflict avoidance with the community at large. Local residents are typically trained and hired through several programs to assist with seismic exploration and exploratory drilling activities, including the Protected Species Observer (PSO) program, Subsistence Advisor (SA) program, Communication and Call Centers (Com Centers) program, and Oil Spill Response. The PSO program would employ, among others, local Inupiat residents to monitor and document protected species in the project area. The PSOs are trained to identify marine mammals and other protected species, document interactions using computers, and comply with health and safety regulations. The SA program recruits local residents to communicate local concerns and subsistence issues. The SA coordinates with other village members and documents subsistence information, which may then be used to develop appropriate mitigation measures, address concerns related to subsistence activities, and to avoid potential conflicts. The Com Center program involves hiring local residents to monitor and relay radio transmissions between subsistence vessels and industry vessels. This sharing of information is intended to reduce or eliminate the potential for conflict between subsistence users and industry vessels. Providing these employment opportunities to local residents creates the potential for positive economic benefits to local communities and provides a vector for communication between industry and local residents.

Comment [JCurtis9]: Isn't tribal consultation and coordination also part of the interaction with these communities, whose residents are mostly tribal members?

Three mechanisms have been and are currently used for communication, cooperation, and conflict avoidance between industry and local communities: Conflict Avoidance Agreements (CAAs), Com Centers, and Plans of Cooperation (POC). The Alaska Eskimo Whaling

Commission requests entering into CAAs with any parties conducting activities during the fall bowhead whale hunt that might potentially interfere with the hunt. A CAA may include all appropriate measures and procedures regarding the timing and areas of the operator's planned activities (i.e., times and places where effects of seismic and/or drilling operations will be monitored and prospectively mitigated to avoid potential conflicts with active subsistence whaling and sealing); communications system between operator's vessels and whaling and hunting crews (i.e., the communications center will be located in strategic areas); provision for marine mammal observers/Inupiat communicators aboard all project vessels; conflict resolution procedures; and provisions for rendering emergency assistance to subsistence hunting crews. Entering into CAAs are not required by federal regulation.

To minimize potential interference with marine mammal hunts on a real-time basis, exploration companies have been asked to participate in the establishment and interaction with Com Centers in affected subsistence communities. The Com Centers are a component of a CAA, are established prior to exploration activities in the vicinity of a potentially affected community, and are operated on a 24-hour basis during the fall bowhead whale hunt. Companies may contribute to the establishment of Com Centers whether or not they sign a CAA.

Where the proposed activity would take place in or near a traditional Arctic subsistence hunting area and/or may affect the availability of a species or stock of marine mammal for Arctic subsistence uses, NMFS requires an applicant to submit a POC or information that identifies what measures have been taken and/or will be taken to minimize any adverse effects on the availability of marine mammals for subsistence uses (50 CFR 216.104(a)(12)). A POC requires consultation and community meetings with potentially affected communities.

2.3.4 Alternative Technologies for Hydrocarbon Exploration

The impulsive airgun has been under scrutiny as a sound source for seismic exploration due to concerns that the propagated sound waves may harm marine life during operations. Alternative acoustic source technologies generally put the same level of useable energy into the water as airguns, but over a longer period of time with a resulting reduced acoustic footprint. One alternative, the low frequency passive seismic method, relies on naturally produced sounds and does not introduce any sound into the environment. These alternative acoustic sources are in various stages of development and none of the systems with the potential to replace airguns as a seismic source are currently commercially available.

Technologies supplemental to seismic operations such as gravity/gradiometry and controlled source electromagnetics are commercially available and discussed in Section 2.3.2.

Comment [ACR10]: BOEMRE – please confirm accuracy of yellow highlighted statements and fill in "Uncertain" information under the last column

Table 2.3. Alternative Technologies Summary

Technology	Availability date	Activity This Technology Could Replace Or Mitigate	Amount per Year it Would Replace
Marine Vibrators – Hydraulic	Estimate should be available within 3 to 5 years.	Could replace airguns once field tests are complete.	Uncertain
Marine Vibrators – Electric	If tests were completed, it could be available in about 5 years. If funds were available, it would take 2 to 4 years to fully develop and test a system for commercial use. NMFS and BOEMRE anticipate marine vibrator technology may be used in the GOM in the near future, possibly up to five surveys over the next five years. However, this estimate is dependent on how quickly the technology advances and the results of field trials.	Could replace airguns once field tests are complete.	Uncertain
Low-frequency Acoustic Source (patented) (LACS)	Two LACS systems are being offered commercially. Field test results of the LACS 4A system demonstrate that the system is currently capable of accurately imaging shallow sediments (~230 meters) within a fjord environment (Askeland et. al. 2008, 2009). The LACS 8A system would likely be available for use in a few years. This system currently does not exist and the project is presently on hold. It would take at least 18 months to build and field test one of these systems if money were available to do so (Jens Abrahamsen, Managing Director Bjørge Naxys personal communication to Jana Lage BOEMRE 12/2/10).	Currently suitable for shallow penetration towed-streamer seismic surveys or vertical seismic profiling. Theoretically has the potential to compete with a conventional deep penetration airgun seismic array.	Uncertain
Deep-Towed Acoustics/Geophysics System (DTAGS)	One year until commercially ready.	Can detect areas missed by surface-towed airguns, with less penetration. DTAGS could not replace a deep penetration airgun array for oil and gas exploration at this time. However, there is no physical limitation to designing a resonant cavity source to simulate the frequency band of air guns.	Uncertain

Technology	Availability date	Activity This Technology Could Replace Or Mitigate	Amount per year it would replace
Low Frequency Passive Seismic Methods for Exploration	Approximately 5 years until ready.	Passive seismic surveys cannot replace active seismic acquisition. However, passive acoustic data have the potential to enhance oil recovery at a better resolution than magnetic or gravimetric methods especially in areas that are environmentally sensitive (Bussat and Kugler 2009).	Uncertain
Fiber Optic Receivers	Available now.	Lower source levels could be achieved through better system optimization, i.e. a better pairing of source and receiver characteristics, and better system gain(s). Fiber optic receivers may allow the use of lower amplitude sources through a higher receiver density and/or a lower system noise floor. Fiber optic receivers could allow use of smaller airguns and arrays but not replace them for exploration purposes.	Uncertain
Electro-mechanical and petrol-driven acoustic projectors	Prototype currently in development. May be commercially available in a few years.	Could potentially replace airguns.	Uncertain
Gravity and Gradiometry	Available now.	In the correct setting, working with an integrated data set of seismic and gravity gradiometry, a better picture of the subsurface can be delivered which may also reduce the amount of seismic needed.	Uncertain
Low Impact Seismic Array (LISA)	No information found; still in development stage.	Use of a large array of small powerful electromagnetic projectors could replace airgun arrays.	Uncertain
3D Controlled Source Electromagnetics (CSEM)	Available now.	Current EM methods have neither the resolution nor the penetration to replace seismic in a significant range of exploration and production applications, but seismic data is more reliable if used in conjunction with CSEM.	Uncertain

Marine Vibrators

Hydraulic

In 1983, Industrial Vehicle International, Inc. (IVI) began developing a new marine vibrator seismic source system with the goal of producing a marine source able to emit a broad band, high amplitude, modulating frequency output. In 1985, the first commercial system was offered (IVI 2003). The developed system consists of a marine vibrator, vibrator controller, and a power unit. The source is capable of generating modulated frequencies between 10 and 250 Hz and can be used in water depths as shallow as one meter.

The system has been tested in various environments from transition zones to deepwater. A comparison of marine vibrator, dynamite, and airgun sources in southern Louisiana concluded that the marine vibrator was a viable source for environmentally sensitive areas (Potter et al. 1997, Smith and Jenkerson 1998). The best performance is on a seafloor which distributes the vibrator's forces.

Initial deep water tests were conducted in the Gulf of Mexico using a vibrator with an energy output approximately equivalent to a 1,000 in^3 (16.4 liter) airgun. Despite limitations of low frequency energy, good definition of reflectors down to three seconds indicated that the system was viable (Haldorsen et al. 1985). In 1996, a comparison between the marine vibrator and the airgun data indicated that the marine vibrator data contained more frequency content above 30 Hz and less frequency content below 10 Hz than the airgun data, but overall the data were comparable. Marine vibrator production rates were slightly lower than those of the airgun, but by the end of the survey, the technical downtime of the marine vibrator was similar to the airgun (Johnson et al. 1997).

IVI continued to further develop the system into the early 2000s, but they are no longer actively marketing the product because there is no client base for the system. The significant expense to retrofit the marine exploration companies' ships to support marine vibrators is not offset by reduced operation costs or better data quality. IVI presently has marine vibrator systems that could be used for seismic data collection, but they would require renovation prior to deployment, which could take three months to a year (Elmo Christensen, Vice President IVI personal communications with Jana Lage 11/09/10, 12/17/10).

Electric

Petroleum Geo-Services (PGS) began developing an electro-mechanical marine vibrator in the late 1990s. The original system consists of two transducers: the lower frequency (6-20 Hz) "Subtone" source and the higher frequency (20-100 Hz) "Triton" source (Tenghamn 2005, 2006). Each vibrator is composed of a flextensional shell that surrounds an electrical coil, a magnetic circuit and a spring element. The sound in the water column is generated by a current in the coil, which causes the spring elements and shell to vibrate. Mechanical resonances from the shell and spring elements allow very efficient, high power generation (Spence et al. 2007; Tenghamn 2005, 2006). The source tow-depth, generally between 5 and 25 m (16 to 82 ft) below the sea surface, is selected depending on the frequency and enhancement from the surface reflection which, to a certain degree, directs the acoustic signal downwards.

The reduction of the overall sound level and specifically the frequencies above 100 Hz, which are beyond the useful seismic range, is a major advantage of the system. Another advantage is

the reduction of acoustic power in comparison with conventional seismic sources, which occurs because the net source energy is spread over a long period of time (Tenghamn 2005, 2006).

During the early period of development, the system proved the concept that it worked as a source for seismic data. However, unreliability prevented it from becoming a commercial system. PGS spent 2006 and 2007 conducting a feasibility study to improve reliability and testing a newly developed prototype. After that work, PGS developed three additional systems that are currently being tested. PGS does not have a commercial system available for data collection at this time. They project that, if funds were available, it would take two to four years to fully develop and test a system for commercial use (Rune Tenghamn, VP Innovation and Business Development PGS, personal communication to Jana Lage 11/09/10).

Low-frequency Acoustic Source (patented)

Originally designed as a ship sound simulator for the Norwegian Navy, the low level acoustic combustion source (LACS) is being promoted as an alternative source for seismic acquisition (Weilgart 2010). The LACS system is a combustion engine with a cylinder, spark plug, two pistons, two lids, and a shock absorber. It creates an acoustic pulse when two pistons push lids vertically in opposite directions; one wave reflects from the sea surface and combines with the downward moving wave. There is no bubble noise from this system as all air is vented and released at the surface, not into the underwater environment. The absence of bubble noise allows the system to produce long sequences of acoustic pulses at a rate of 11 shots per second; this allows the signal energy to be built up in time with a lower amount of energy put into the water (Askeland et. al. 2007, 2009).

Two LACS systems are being offered commercially. The LACS 4A has a diameter of 400 mm, a height of 600 mm and a weight of approximately 100 kg in air. Field test results of the LACS 4A system demonstrate that the system is capable of accurately imaging shallow sediments (~230 meters) within a fjord environment (Askeland et. al. 2008, 2009). This system is suitable for shallow penetration towed-streamer seismic surveys or vertical seismic profiling (Askeland et. al. 2008).

The second system, the LACS 8A, theoretically has the potential to compete with a conventional deep penetration airgun seismic array. The weight is 400 kg (882 pounds) and the diameter is 800 mm (31.5 inches). Several LACS units may be operated together to provide an increased pulse pressure. (Bjørge Naxys AS 2010). This system currently does not exist and the project is presently on hold. It would take at least 18 months to build and field test one of these systems if money came available to do so (Jens Abrahamsen, Managing Director Bjørge Naxys personal communication to Jana Lage 12/2/10).

Deep-Towed Acoustics/Geophysics System

The U.S. Navy developed a deep-towed acoustics/geophysics system (DTAGS) to better characterize the geoacoustic properties of abyssal plain and other deep-water sediments. The system was tested and modified in the early 1990s and used in various locations around the world until it was lost at sea in 1997 (Gettrust et al. 1991; Wood et al. 2003).

The second generation DTAGS is based on the original design but with more modern electronics. The source is extremely flexible, allowing for changes in waveform and decrease in

sound level to produce a source amplitude, waveform, and frequency to suit specific requirements (Wood et al. 2003; Wood 2010).

The DTAGS is towed behind a survey vessel usually at a level of 100 m above the seafloor and a vessel speed of two knots; it can operate at full ocean depths (6,000 m). A 450 meter, 48 channel streamer array is towed behind the source to record the reflected signals. DTAGS can also be configured with an aluminum landing plate, which transmits the acoustic energy directly into the seafloor. With this configuration, vertical bottom founded hydrophone arrays are used to receive reflections (Breland 2010).

Proximity of the acoustic source to the seafloor is an advantage of the DTAGS system. The system has a limit of 1 km penetration in most marine sediments (Wood et al. 2003). It has been used very successfully to map out gas hydrates in the Gulf of Mexico (Wood et al 2008), Canadian Pacific (Wood et al. 2002; Wood and Gettrust 2000) and Blake Ridge (Wood and Gettrust 2000).

There is only one DTAGS in existence at this time. While it has imaged shallow sediments and gas hydrate environments extremely well, the current tool design could not replace a deep penetration airgun array for oil and gas exploration at this time - DTAGS was not designed for this purpose. However, there is no physical limitation to designing a resonant cavity source to simulate the frequency band of airguns.

Low Frequency Passive Seismic Methods for Exploration

Low frequency passive seismic methods utilize microseisms, which are faint Earth tremors caused by the natural sounds of the earth, to image the subsurface. A typical survey consists of highly sensitive receivers (usually broadband seismometers) placed in the area of interest to collect data over a period of time. Upon completion of the survey, the data are analyzed and filtered to remove all non-natural sounds, which is most efficiently completed using an automated process (Hanssen and Bussat 2008).

All of the current methods use one of following three sources of natural sounds: natural seismicity, ocean waves, or microseism surface waves. Natural seismicity uses the Earth's own movements as a source of energy. Two techniques have been developed to utilize this energy source:

Daylight Imaging (DLI) uses the local seismicity of an area to produce reflection seismic profiles, similar to those recorded in active seismic surveys (Claerbout, 1968). As in active reflection seismic operations, geophones are deployed; the target can be imaged using regularly-spaced 2D line geometry (Hohl and Mateeva 2006; Draganov et al. 2009).

Local Earthquake Tomography (LET) also uses local seismicity of a region to map on the reservoir scale (Kapotas et al. 2003). However, it is used to calculate the velocity structure of the subsurface in 3D by analyzing each earthquake on multiple receivers and generating ray paths instead of cross-correlating the recorded signals.

Ocean waves are used as a sound source for the Sea Floor Compliance technique. The method requires that Ocean Bottom Seismometer stations with highly-sensitive, broadband seismometers and differential or absolute pressure gauges be installed in water several hundred meters deep.

Ambient-Noise (Surface-Wave) Tomography [AN(SW)T] uses low frequency (between 0.1 and 1 Hz) ambient noise records to estimate shear wave velocities and structural information about

the Earth. This technique requires the use of broadband seismometers to record the low frequency surface waves, which can penetrate to depths of several kilometers (Bensen et al. 2007, 2008). AN(SW)T can be used in areas where seismic data are difficult to collect or in environmentally sensitive areas. While this technology is new and still in need of further testing, the lateral resolution at several kilometer depths may reach a few hundred meters and the resolution may be better than gravimetric or magnetic data, which is promising for oil and gas exploration (Bussat and Kugler 2009).

Surface-wave amplitudes is a one-dimensional (1D) method that images the geological structure of the sub-surface by analyzing passive acoustic data that have not been geophysically processed. The transformation of incoming micro-seismic surface-waves, scattered at vertical discontinuities, into body waves may produce these data, but the process is not well understood (Gorbatikov et al. 2008).

Low-Frequency Spectroscopy (LFS) is also known as Low Frequency Passive Seismic (LFPS) or Hydrocarbon Microtremor Analysis (HyMAS) tests for an indication of subsurface hydrocarbon accumulation using spectral signatures gathered from the ambient seismic wave field recorded by broadband seismometers. However, this methodology is highly dependent on the ability to process out all anthropogenic noise and topography (Hanssen and Bussat 2008). This method is still in the early stage of development and has not been confirmed in the field during any studies (Ali et al. 2007; Al-Faraj 2007).

The most successful use of low frequency passive micro-seismic data has been on land where it is easier to isolate the extraneous noise from the natural signal. The technique is also promising in the marine environment. To ensure success of a marine survey: (1) it is imperative that the recording instruments are in proper contact with the substrate (the natural signal may not be accurately recorded in unconsolidated material) and (2) the increase in both anthropogenic and naturally produced noise in the marine environment is correctly filtered so that it does not mask the signal of interest.

Like the CSEM technique that is discussed in Section 2.3.2, passive seismic surveys cannot replace active seismic acquisition. However, passive acoustic data have the potential to enhance oil recovery at a better resolution than magnetic or gravimetric methods (Bussat and Kugler 2009) especially in areas that are environmentally sensitive or active seismic operations are difficult.

Fiber Optic Receivers

Fiber optic receivers are receivers that incorporate optical fibers to transmit the received acoustic signal as light. They are most frequently used in the petroleum industry for seismic Permanent Reservoir Monitoring, a four-dimensional (4D) reservoir evaluation application. The optical receivers are permanently placed on the seafloor, ensuring consistency and repeatability of the 4D surveys, better signal to noise ratios, and quality of subsequently collected data. Fiber optic systems are not new and have proven to be highly reliable.

Fiber optic receivers are more sensitive than standard receivers, which allows for smaller airgun arrays to be used. While these receivers offer a benefit to the environment through a decrease in airgun noise, this technology is not presently available for towed-streamer surveys.

Fiber optic receivers have not been used in the Alaska OCS due to the lack of large scale offshore production requiring 4D monitoring. This technology is associated with production, and therefore is not analyzed further in this document.

Mitigation Measures in Development

Industry and the public sector have actively investigated the use of technology-based mitigation measures to reduce anthropogenic noise and thus potentially reduce the impacts of current methods of hydrocarbon data collection. Some of these technologies are not yet available and may not work in all circumstances.

Airgun Silencer

One such measure, an airgun silencer, which has acoustically absorptive foam rubber on metal plates mounted radially around the airgun, has demonstrated 0-6 dB reductions at frequencies above and 0-3 dB reductions below 700 Hz. This system has been tested only on low pressure airguns and is not a viable mitigation tool because it needs to be replaced after 100 shots (Spence et al. 2007). Other tests are being conducted to attenuate unwanted high frequency energy without affecting the frequencies of interest.

Airgun Design

Another mitigation measure in development is optimizing the design of the airgun to reduce unwanted energy through array, source, and receiver design optimization in both the inline and horizontal plane of interest. There are other tests to lower source levels through better pairing of source and receiver characteristics or better system gains.

Bubble Curtain

Bubble curtains generally consist of a rubber hose or metal pipe with holes to allow air passage and a connector hose attached to an air compressor. They have successfully been tested and used in conjunction with pile driving and at construction sites to frighten away fish and decrease the noise level emitted into the surrounding water (Würsig et al. 2000; Sexton 2007; Reyff 2009). They have also been used as standalone units or with light and sound to deflect fish away from dams or keep them out of specific areas (Weiser 2010; Pegg, M. 2005).

The use of bubbles as a mitigation for seismic noise has also been pursued. During an initial test of the concept, the sound source was flanked by two bubble screens; it demonstrated that bubble curtains were capable of attenuating seismic energy up to 28 dB at 80 Hz while stationary in a lake. This two-bubble curtain configuration was field tested from a moving vessel in Venezuela and Aruba where a 12 dB suppression of low frequency sound and a decrease in the sound level of laterally projecting sound was documented (Sixma 1996; Sixma and Stubbs 1998). A different study in the Gulf of Mexico tested an "acoustic blanket" of bubbles as a method to suppress multiple reflections in the seismic data. The results of the acoustic blanket study determined that suppression of multiples was not practical using the current technology. However, the acoustic blanket measurably suppressed tube waves in boreholes and has the capability of blocking out thruster noises from a laying vessel during an OBC survey, which would allow closer proximity of the shooting vessel and increase productivity (Ross et al. 2004, 2005).

A recent study "Methods to Reduce Lateral Noise Propagation from Seismic Exploration Vessels" was conducted by Stress Engineering Services Inc. under the BOEMRE Technology Assessment & Research (TA&R) Program. The first phase of the project was spent researching,

developing concepts for noise reduction, and evaluating the following three concepts: (1) an air bubble curtain; (2) focusing arrays to create a narrower footprint; and (3) decreasing noise by redesigning airguns. The air bubble curtain was selected as the most promising alternative, which led to more refined studies the second year (Ayers et al. 2009). A rigorous 3D acoustic analysis of the preferred bubble curtain design, including shallow-water seafloor effects and sound attenuation within the bubble curtain, was conducted during the second phase of the study. Results of the model indicated that the bubble curtains performed poorly at reducing sound levels and are not viable for mitigation of lateral noise propagation during seismic operations from a moving vessel (Ayers et al. 2010).

2.4 Alternatives Considered in the EIS

The federal actions considered in this EIS are the issuance of ITAs under the MMPA for G&G, high resolution, and exploratory drilling activities in the Beaufort and Chukchi Seas and the issuance of G&G and high resolution permits by the BOEMRE for these same areas. [Again, BOEMRE plans to use this document to support any issuance of G&G and high resolution permits under the OCS Lands Act and to also supplement its project-specific NEPA done in relation to exploratory drilling.] Given the widespread presence of numerous marine mammals in the Beaufort and Chukchi Seas and the nature of oil and gas exploration activities, it is likely that any amount of seismic and exploratory drilling activities may result in the disturbance of marine mammals through sound, discharge of pollutants, and/or the physical presence of vessels. An ITA would be required, as well as approval by BOEMRE under a G&G permit. While BOEMRE addresses issues associated with discharge when it conducts site-specific NEPA for EPs, additional mitigation measures to address eliminating certain discharge streams are also included for analysis of environmental consequences.

Comment [HS11]: What does "discharge" mean in this context? Water or air, or neither? Also, please confirm that BOEMRE addresses issues associated with water discharges in its site-specific NEPA evaluations.

Pursuant to the MMPA, NMFS is required to authorize, upon request, the taking of small numbers of marine mammals of a species or population stock if the agency is able to find that the taking from the specified activity will have a negligible impact on the affected species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses. NMFS must also prescribe the permissible methods of taking pursuant to the activity; the means of effecting the "least practicable adverse impact" on the affected species or stock and its habitat; and requirements pertaining to the monitoring and reporting of such taking.

The approach taken in identifying alternatives considered by NMFS and BOEMRE in this EIS involve four major components:

1) Evaluating alternative concepts suggested during the scoping period;
2) Reviewing potential alternatives in the context of NMFS and BOEMRE's regulatory requirements;
3) Assessing potential levels of seismic exploration and exploratory drilling activities, and a suite of Required Standard Mitigation Measures, and
4) Identifying a range of potential Additional Mitigation Measures that need further analysis and may be applied to alternatives pursuant to the MMPA ITA process and the BOEMRE OCS Lands Act permitting process.

Review of Multiple Exploration Activities

Past ITAs have been issued for individual G&G, high resolution, and exploratory drilling projects in the Arctic Seas. These authorizations have been in the form of Incidental Harassment Authorizations (IHA) issued for periods of no more than one year at a time. NMFS' review of individual IHA applications and the results of monitoring programs required by past IHAs have been conducted with a "collective" perspective concerning multiple exploration activities taking place at different locations within the same geographic area. The purpose of this EIS is to analyze effects from multiple oil and gas industry exploration activities with regard to marine mammals and subsistence hunting, assess the potential effects of authorizing takes from concurrent activities, and analyze whether the standard mitigation and monitoring measures stipulated in the past are appropriate. Additional mitigation measures to address potential marine mammal or subsistence impacts from the activities have been suggested by the public or other agencies and the potential effectiveness of these measures will also be analyzed.

For planning purposes, NMFS and BOEMRE can predict level of activities a few years out given the upcoming lease sales and industry needs for developing those leases. Although these can be somewhat predicted, the particular strategy for where and when to explore for resources may change over time depending on what a company finds during previous exploration, as well as changes in technology. Furthermore, outside forces (i.e., the price of oil) and politics may affect the oil and gas market and play a role in how much effort is applied to exploration in the Arctic. Therefore, predicting and planning for levels of activity over a long period of time can sometimes be difficult. For a given year of activity, communications for upcoming G&G and exploratory drilling activities are ongoing between NMFS, BOEMRE, and industry throughout the year; but NMFS and BOEMRE are officially notified of the specific planned activities upon receipt of an application for an ITA or G&G permit, which may be submitted just several months prior to the activity taking place. Therefore, while NMFS and BOEMRE have a good idea about proposed activities on an annual basis, there is usually some level of uncertainty.

Review of Mitigation Measures

The evaluation of measures intended to reduce adverse impacts to marine mammals and other protected resources is a primary focus of this document and is a primary component of the alternative development. Mitigation is addressed in the action alternatives in three different ways:

1) **Required Standard Mitigation Measures** – These measures, which are required in all four of the action alternatives, are those that NMFS and BOEMRE have agreed are appropriate to *require* in every G&G permit and MMPA authorization. Typically, these measures have been used consistently in past permits and authorizations (e.g., shutdown zones, known subsistence time/area closures).
2) **Additional Mitigation Measures** – These measures, which are evaluated *but not required* in all four action alternatives, may or may not be implemented in future activities depending on the outcome of the MMPA authorization processes (or other environmental compliance processes) associated with those future actions. These measures are intended to include other reasonable potential mitigation measures, such as those that have been used or considered in the past or recommended by the public.

3) **Alternatives 4 and 5** – These two alternatives are characterized by specific mitigation measures associated with time/area closures or alternative technologies. These alternatives are characterized by specific additional mitigation measures that are intended to minimize impacts to marine mammals and subsistence uses.

All of the mitigation measures described above are comprehensively evaluated in the context of the anticipated benefits to marine mammals, likely effectiveness, and practicability for implementation of the measures. This analysis, which also includes consideration of the public comments received on previous proposed ITAs during the scoping period, is needed in order to better assess the appropriateness of each measure given certain activity levels and locations (and other considerations). From NMFS' perspective, the full analysis of any additional mitigation measures will inform future decisions of whether: a) the measure should be considered a standard measure (i.e., implemented in every ITA); b) the measure should never be implemented, or; c) the measure should be implemented based on attributes of the specific project in combination with the other known activities for that year. This analysis can be found in Chapter 4 of this document.

In this EIS, NMFS and BOEMRE present and assess a reasonable range of G&G, high resolution, and exploratory drilling activity, as well as a reasonable range of measures intended to reduce adverse impacts on the human environment, that can be expected to take place in order to accurately assess the potential consequences of issuing ITAs under the MMPA and permits under the OCS Lands Act. Based upon past lease sales, G&G permits, ancillary activity permits, drilling exploration activities, and requests for ITAs, NMFS and BOEMRE have determined a reasonable range and level of activities that may be requested to take place in the foreseeable future. While the level of activity proposed in the foreseeable future may vary from one year to the next, the structure of the action alternatives represents a reasonable range of exploration activities that may be proposed for which ITAs may be requested.

The following alternatives are summarized in Table 2.4.

2.4.1 Alternative 1 – No Action

Under the No Action Alternative, NMFS would not issue any ITAs under the MMPA for seismic surveys or exploratory drilling in the Beaufort and Chukchi Seas, and BOEMRE would not issue G&G or ancillary activity permits for activities in the Beaufort and Chukchi Seas. If companies proceeded to operate in this area without MMPA authorizations, any takes of marine mammals would occur in violation of the MMPA. NEPA's implementing regulations require that the No Action Alternative be evaluated.

2.4.2 Alternative 2 – Authorization for Level 1 Exploration Activity

Alternative 2 is defined for analytical purposes as the following (Figure XX):

Level of Activity

- Up to **three** 2D/3D seismic surveys in the Beaufort Sea and up to **three** in the Chukchi Sea per year, with up to **one** in each sea including ice breaking if necessary.
- Up to **three** site clearance and high resolution surveys in the Beaufort Sea and up to **three** in the Chukchi Sea per year.

- **One** exploratory drilling program in the Beaufort Sea and **one** in the Chukchi Sea per year.

Comment [HS12]: It is important to clarify what "one exploratory drilling program per year" means. One well? Several wells drilled by one rig? One company?

Comment [JCurtis13]: (Per D. Soderlund) Also consider one drillship that is operated and/or leased by several companies drilling several wells on lease blocks with different leasees.

Mitigation

- Including *required* Standard Mitigation Measures (described in Section 2.4.6) that are part of every action alternative.
- Including a full analysis of a wide range of Additional Mitigation Measures (described in Section 2.4.7) that *could potentially* be required through the MMPA process and could vary by alternative (i.e. some might be different based on level of activity in a year)

Assumptions

Seismic work in the Arctic has traditionally been conducted in ice-free months (July through October), although this analysis addresses the possibility of one survey utilizing an icebreaker and potentially continuing through mid-December. Each survey takes between 30 and 60 days, depending on ice conditions, weather, equipment operations, etc. Because of the limited time period of open water, it is likely that concurrent surveys would be conducted in the same general time frame and may overlap in time, but will not overlap in space for safety considerations and data integrity. It is assumed for analytical purposes that at least one of the authorized 2D/3D seismic surveys in the Beaufort Sea and one in the Chukchi Sea would utilize an ice breaker.

Exploratory activities (including deep penetration, high resolution, and exploratory drilling) in the next five years will focus on areas of recently purchased leases. In the U.S. Beaufort Sea, the two primary areas of interest for exploration are nearshore in Camden Bay near Kaktovik and Harrison Bay. In the U.S. Chukchi Sea, the areas of interest are all well offshore in the lease areas, particularly around drill sites from the 1980s including Shell's Burger, Crackerjack, and Shoebill sites; ConocoPhillips' Klondike site; and Statoil's leases in the northeast part of the Lease Sale 193 area (see Figure XX).

2.4.3 Alternative 3 – Authorization for Level 2 Exploration Activity

Alternative 3 is defined for analytical purposes as the following (Figure XX):

Level of Activity

- Up to **five** 2D/3D seismic surveys in the Beaufort Sea and up to **five** in the Chukchi Sea per year, with up to **one** in each sea including ice breaking if necessary.
- Up to **five** site clearance and high resolution surveys in the Beaufort Sea and up to **five** in the Chukchi Sea per year.
- Up to **two** exploratory drilling programs in the Beaufort Sea and up to **two** in the Chukchi Sea per year.

Mitigation

- Including *required* Standard Mitigation Measures (described in Section 2.4.6) that are part of every action alternative.

- Including a full analysis of a wide range of Additional Mitigation Measures (described in Section 2.4.7) that *could potentially* be required through the MMPA process and could vary by alternative (i.e. some might be different based on level of activity in a year).

Assumptions for the analysis of Alternative 3 would be the same as those listed for Alternative 2.

2.4.4 Alternative 4 – Authorization for Level 2 Exploration Activity With Additional Required Time/Area Closures

Alternative 4 is defined for analytical purposes as the following (Figure XX):

Level of Activity

- Up to **five** 2D/3D seismic surveys in the Beaufort Sea and up to **five** in the Chukchi Sea per year, with up to **one** in each sea including ice breaking if necessary.
- Up to **five** site clearance and high resolution surveys in the Beaufort Sea and up to **five** in the Chukchi Sea per year.
- Up to **two** exploratory drilling programs in the Beaufort Sea and up to **two** in the Chukchi Sea per year.

Comment [HS14]: Same as comment HS4, above.

Mitigation

- Including *required* Standard Mitigation Measures (described in Section 2.4.6) that are part of every action alternative.
- Including a full analysis of a wide range of Additional Mitigation Measures (described in Section 2.4.7) that *could potentially* be required through the MMPA process and could vary by alternative (i.e. some might be different based on level of activity in a year)
- Including additional *required* time/area closures for specific areas important to biological productivity, life history functions for specific species of concern, and subsistence activities. These areas are shown on Figure XX, and are described in detail in Chapter 3, Section 3.XX and under additional mitigation measures described in Appendix XX:
    - Camden Bay – An area of high biological productivity, including kelp communities; a feeding area for bowhead whales (including subadults and females with calves); fall subsistence bowhead whale hunting area.
    - Barrow Canyon – An area of high biological productivity; a feeding area for bowhead whales; fall subsistence bowhead whale hunting area.
    - Hannah Shoal – An area of high biological productivity (benthic organisms); a feeding area for various marine mammals (walrus, gray whales, and bearded seals).
    - Kasegaluk Lagoon/Ledyard Bay Critical Habitat Unit – An important habitat for beluga whales, spotted seals, and spectacled eiders; subsistence beluga whale hunting area.

Assumptions for the analysis of Alternative 4 would be the same as those listed for Alternative 2.

2.4.5 Alternative 5 – Authorization for Level 2 Exploration Activity With Use of Alternative Technologies

Alternative 5 is defined for analytical purposes as the following (Figure XX):

Level of Activity

- Up to **five** surveys (utilizing either airguns or an alternative technology, as described below, in lieu) in the Beaufort Sea and up to **five** in the Chukchi Sea per year, with up to **one** in each sea including ice breaking if necessary.
- Up to **five** site clearance and high resolution surveys in the Beaufort Sea and up to **five** in the Chukchi Sea per year.
- Up to **two** exploratory drilling programs in the Beaufort Sea and up to **two** in the Chukchi Sea per year.

Comment [HS15]: Same as comment HS4, above.

Mitigation

- Including *required* Standard Mitigation Measures (described in Section 2.4.6) that are part of every action alternative.
- Including a full analysis of a wide range of Additional Mitigation Measures (described in Section 2.4.7) that *could potentially* be required through the MMPA process and could vary by alternative (i.e. some might be different based on level of activity in a year), potentially including new mitigations developed to apply to new technologies.
- Including specific Additional Mitigation Measures that focus on the use of alternative technologies that augment or replace traditional airgun-based seismic exploration activities.

Assumptions for the analysis of Alternative 5 would be the same as those listed for Alternative 2.

2.4.6 Standard Required Mitigation Measures

The following mitigation measures (and the identified mitigation monitoring needed to support them) are planned for inclusion as a requirement under every ITA issued for the type of activity identified (DS=Deep Penetration Seismic Survey, HRS=High Resolution Seismic, D=Drilling, IB=Icebreaking, or All). In addition, some or all of these measures may also be included in G&G permit approvals by BOEMRE. Full descriptions of these measures are contained in Appendix XX.

a) Detection-based measures intended to reduce near-array acoustic exposures and impacts on marine mammals within a given distance of the source

- Establishment of 180 dB shutdown/power down radius for cetaceans and 190 dB shutdown/power down radius for pinnipeds (DS, HRS).
- Specified ramp-up procedures for airgun arrays (DS, HRS).
- Protected Species Observers (PSOs) required on all seismic source vessels and ice breakers (DS, HRS, IB).

b) Non-detection-based measures intended to more broadly lessen the severity of acoustic impacts on marine mammals or reduce overall numbers taken by acoustic source

- Specified flight altitudes for all support aircraft except for take-off, landing, and emergency situations (All).

c) Measures intended to reduce/lessen non-acoustic impacts on marine mammals

- Specified procedures for changing vessel speed and/or direction to avoid collisions with marine mammals (All).
- Notification of lost equipment that could pose a danger to marine mammals (All).
- Operators are required to have a plan(s) in place that a) minimize the likelihood of a spill; b) outline the response protocol in the event of the spill, and; c) identify the means of minimizing impacts to marine mammals following a spill. (D).
- Operators are required to limit discharges and recycle drilling muds to the extent practicable (D).

d) Measures intended to reduce/lessen impacts to subsistence uses

- Shutdown of activities occurring in the Beaufort Sea (east of a certain line) from on or around August 25 until the close of the Nuiqsut (Cross Island) and Kaktovik fall bowhead whale hunts (All).
- Establishment and utilization of Communication Centers in subsistence communities to address potential interference with marine mammal hunts on a real-time basis throughout the season (All).
- Required flight altitudes and paths for all support aircraft in areas where subsistence occurs, except during take-off, landing, and emergency situations (All).

Comment [JCurtis16]: (Per D. Soderlund) This should be more clearly described here – does this mean air and water discharges? Limit all discharges, or those waste streams of most concern?

Comment [ACR17]: Input from AEWC, ABWC, and ISC requested on this section. See Appendix for full listing.

2.4.7 Additional Mitigation Measures

The following mitigation measures (and mitigation monitoring needed to support them) will be comprehensively evaluated in Chapter 4 and may be required by NMFS in ITAs to make the necessary findings under the MMPA for the type of activity identified (DS=Deep Seismic Survey, HRS=High Resolution Seismic, D=Drilling, IB=Icebreaking, or All). In addition, some or all of these measures may also be included in G&G permit approvals by BOEMRE. Full descriptions of these measures are contained in Appendix XX.

a) Detection-based measures intended to reduce near-array acoustic exposures and impacts on marine mammals within a given distance of the source

- Sound source verification tests for sound sources and vessels at the start of the season (All).
- Measures to assess the efficacy and improve detection capabilities in low visibility situations (e.g. Forward Looking Infrared [FLIR] imaging devices, 360° thermal imaging devices) (DS, HRS, IB).
- Limiting activities in situations of low visibility.

- Measures to increase detection probability for real-time mitigation (e.g. to maintain 180 dB shutdown zones), such as passive and active acoustic monitoring (DS, HRS, IB).
- Enhancement of monitoring protocols and mitigation shutdown zones to minimize impacts in specific biologic situations (e.g cow/calf groups and feeding or resting aggregations) (All).

b) Non-detection-based measures intended to more broadly lessen the severity of acoustic impacts on marine mammals or reduce overall numbers taken by acoustic source

- Temporal/spatial limitations to minimize impacts in particular important habitats, including Camden Bay, Barrow Canyon, Hannah Shoal, and Kasegaluk Lagoon/Ledyard Bay Critical Habitat Unit (All).
- Limits to overlap and orientation in time and space of ensonified zone of authorized projects (All).
- NMFS or BOEMRE restricting number of surveys (of same level of detail) that can be conducted in the same area in a given amount of time (i.e., to avoid needless collection of identical data) (All).

c) Measures intended to reduce/lessen non-acoustic impacts on marine mammals

- Vessel and aircraft avoidance of concentrations of groups of walruses and polar bears (All).
- Requirements to ensure zero discharge, or reduced discharge, of the specific discharge streams identified with potential impacts to marine mammals or marine mammal habitat (All).

Comment [JCurtis18]: (Per D. Soderlund) Again clarify zero discharge – does this include deck drainage, cooling water, etc? Air and water? Harmful pollutants or all discharges? What criteria will be used to evaluate this?

d) Measures intended to reduce/lessen impacts to subsistence uses

Comment [ACR19]: Input from AEWC, ABWC, and ISC requested on this section. See Appendix for full listing.

- No transit of exploration vessels into the Chukchi Sea prior to July 1 (All).
- Shutdown of activities in the Beaufort Sea for the Nuiqsut (Cross Island) and Kaktovik bowhead whale hunts based on real-time reporting of whale presence and hunting activity rather than a fixed date (All).
- Shutdown of exploration activities in the Chukchi Sea for the Barrow (the area circumscribed from the mouth of Tuapaktushak Creek due north to the coastal zone boundary, to Cape Halkett due east to the coastal zone boundary) and Wainwright (the area circumscribed from Point Franklin due north to the coastal zone boundary, to the Kuk River mouth due west to the coastal zone boundary) bowhead whale hunts based on real-time reporting of whale presence and hunting activity rather than a fixed date (All).
- Transit restrictions into the Chukchi Sea modified to allow off-shore travel under certain conditions (e.g. 32 km [20 mi] from the coast) if beluga whale, fall bowhead whale (Barrow and Wainwright), and other marine mammal hunts would not be affected (All).
- Pre-set time/area restrictions to avoid hunting activities other than the Kaktovik and Nuiqsut (Cross Island) bowhead whale hunts (All).
- Shutdown zone if whaling or sealing vessel approaches an industry operation (All).

2.4.8 Marine Mammal Monitoring Programs and Reporting Requirements

In addition to the measures outlined above, the MMPA and NMFS' implementing regulations require that an applicant conduct monitoring of marine mammals in the designated activity area. According to 50 CFR 216.108(c), the monitoring program must, if appropriate, document the effects (including acoustic effects) on marine mammals and document or estimate the actual level of take as a result of the activity. Additionally, the program should increase the knowledge of the affected species or increase knowledge of the anticipated impacts on marine mammal populations.

Monitoring plans are submitted as part of the MMPA ITA application. NMFS reviews the monitoring plans prior to issuing an ITA to ensure it meets the goals stated above. If an activity may affect the availability of a marine mammal species or stock for taking for subsistence uses, the proposed monitoring plan must be independently peer-reviewed prior to issuance of the ITA (50 CFR 216.108(d)).

There are two different types of monitoring that are most often included in monitoring plans submitted as part of the MMPA ITA application. The first type is what NMFS often refers to as mitigation monitoring. Mitigation monitoring is used to detect and localize marine mammals so that mitigation measures, which ensure that the activity is being conducted in a way to effect the least practicable adverse impact on marine mammals, may be implemented (*e.g.*, monitoring the area immediately adjacent to an activity to ensure there are no marine mammals about to enter the 180- or 190-dB exclusion zones). The second type of monitoring relates to the applicant's specific statutory responsibility to monitor marine mammals in order to document the potential effects and level of take resulting from the applicant's action (*e.g.*, use of regional aerial surveys to assess changes in distribution).

Mitigation monitoring will be assessed along with the mitigation it accompanies, as described above and in Appendix XX and analyzed in Chapter 4. The second type of monitoring described above will be further discussed in Chapter 5 through the following:

- A more detailed description of the goals of the required monitoring
- A description/summary of the types of monitoring that have been required in the past and the nature of the data that has been collected
- A discussion of the different methods/structure for peer-review used to date, including their comparative success, and discussion of any recommended means of improving the peer-review process.
- A discussion of different methods/frameworks that NMFS can use for:
    - Identifying specific existing data gaps that can potentially be addressed through monitoring
    - Prioritizing monitoring needs in advance to inform would be applicants and management decisions/recommendations

Reporting Requirements

The following reports will always be required; additional reporting requirements that may be required are listed in Appendix XX.

- When required, Field Source Verification and the distances to the various isopleths are to be reported to NMFS within five days of completing the measurements. In addition to reporting the radii of specific regulatory concern, distances to other sound isopleths down to 120 dB rms (if measurable) will be reported in increments of 10 dB.
- Seismic Vessel Monitoring Program: A draft report will be submitted to the Director, Office of Protected Resources, NMFS, within 90 days after the end of any seismic survey program in the Arctic Seas. The report will describe in detail (at a minimum): (i) the operations that were conducted; (ii) the results of the acoustical measurements to verify the safety radii; (iii) the methods, results, and interpretation pertaining to all monitoring tasks; (iv) the results of that year's shipboard marine mammal monitoring; (v) a summary of the dates and locations of seismic operations, including summaries of power-downs, shutdowns, and ramp-up delays; (vi) marine mammal sightings (species, numbers, dates, times and locations; age/size/gender, environmental correlates, activities, associated seismic survey activities); (vii) estimates of the amount and nature of potential take (exposure) of marine mammals (by species) by harassment or in other ways to industry sounds; (viii) an analysis of the effects of seismic operations (e.g., on sighting rates, sighting distances, behaviors, movement patterns of marine mammals); (ix) an analysis of factors influencing detectability of marine mammals; and (x) summaries on communications with hunters and potential effects on subsistence uses.
- The draft report will be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final report prior to acceptance by NMFS. The draft report will be considered the final report for this activity under the Authorization if NMFS has not provided comments and recommendations within 90 days of receipt of the draft report.
- A draft comprehensive report describing the acoustic and vessel-based monitoring programs will be prepared and submitted within 240 days of the date of the Authorization. The comprehensive report will describe the methods, results, conclusions and limitations of each of the individual data sets in detail. The report will also integrate (to the extent possible) the studies into a broad based assessment of all industry activities and their impacts on marine mammals in the Arctic Seas during the year.
- The draft comprehensive report will be subject to review and comment by NMFS, the AEWC, and the North Slope Borough Department of Wildlife Management. The draft comprehensive report will be accepted by NMFS as the final comprehensive report upon incorporation of comments and recommendations.

BOEMRE Environmental Studies Program

The OCS Lands Act, as amended, established policy for the management of the OCS energy and minerals and for the protection of marine and coastal environments. Section 20 of the OCS Lands Act authorizes an Environmental Studies Program (ESP). The ESP aims to establish the information needed for assessment and management of environmental impacts on the human, marine, and coastal environments of the OCS and the potentially affected coastal areas, to predict impacts on the marine biota which may result from chronic, low level pollution or large spills associated with OCS production, from drilling fluids and cuttings discharges, pipeline emplacement, or onshore facilities, and to monitor human, marine, and coastal environments to

provide time series and data trend information for identification of significant changes in the quality and productivity of these environments, and to identify the causes of these changes. Nationally, the applied research conducted through the ESP contributes to management of OCS activities from the earliest stage of OCS planning through the final removal of the OCS structure at the end of its productive life.

The *Alaska Annual Studies Plan* complements and reinforces the goals of the Environmental Studies Program. The ESP is guided by several broad themes, which include:

- Monitoring Marine Environments
- Conducting Oil-Spill Fate and Effects Research
- Minimizing Seismic and Acoustic Impacts
- Understanding Social and Economic Impacts
- Maintaining Efficient and Effective Information Management

To be prepared to make decisions arising from activities associated with current oil and gas leases and potential future leasing and changing offshore technologies, the Alaska OCS Region continually proposes new studies and pursues information needs in conjunction with ESP goals. Due to the great differences that exist between Alaskan environments and other OCS areas, the Alaska ESP remains especially flexible in planning and implementing needed studies. At each step of the offshore leasing and development process, a variety of potential issues or resource-use conflicts may be encountered. Two questions are fundamental:

- What is the expected change in the human, marine and coastal environment due to offshore activity?
- Can undesirable change be minimized by mitigating measures?

Environmental studies are the primary means to provide information on these questions for use by decision-makers. Currently the Alaska ESP has primary focus on upcoming developments, exploration activities and existing leases, as well as potential future lease sales, in the Beaufort Sea and Chukchi Sea Planning Areas. Current offshore oil and gas-related issues addressed by ongoing and proposed studies in the Beaufort Sea and the Chukchi Sea include, but are not limited to:

- What refinements are there to our knowledge of major oceanographic and meteorological processes and how they influence the human, marine and coastal environment?
- What role will currents play in distribution of anthropogenic pollutants near development prospects?
- What long-term changes in heavy metal and hydrocarbon levels may occur near Beaufort Sea development prospects, such as Liberty, or regionally along the Beaufort Sea coast?
- How do we improve our model predictions of the fate of potential oil spills?
- If oil is spilled in broken ice, what will its fate be?
- What effects might pipeline construction have on nearby marine communities or organisms?

- What changes might occur in sensitive benthic communities such as the Stefansson Sound "Boulder Patch," and other Beaufort Sea kelp communities or fish habitats?
- What are the current spatial and temporal use patterns of these planning areas by species that are potentially sensitive, such as bowhead whales, polar bears, ice seals, walrus, other marine mammals, seabirds and other birds, or fish?
- What is the extent of endangered whale feeding in future proposed or potential lease sale areas?
- What changes might occur in habitat use, distribution, abundance, movement or health of potentially sensitive key species such as bowhead whales, polar bears, ice seals, walrus, other marine mammals, seabirds and other birds, or fish?
- What interactions between human activities and the physical environment have affected potentially sensitive species?
- What changes might occur in socioeconomics and subsistence lifestyles of coastal Alaska communities?
- What are current patterns of subsistence harvest, distribution and consumption and what changes might occur in key social indicators as a result of offshore exploration and development?
- How can we continue to integrate local and/or traditional knowledge into studies related to the Alaska ESP?

An example of Alaska's Studies Plan can be found at the BOEMRE website at http://alaska.boemre.gov/ess/essp/sp2011.pdf. Further information on Alaska's Environmental Studies Program can be found at http://alaska.boemre.gov/ess/.

2.5 Alternatives and Mitigation Measures Considered but Dismissed From Further Evaluation

Comments received during the scoping process have suggested features that should be incorporated into project alternatives (Table 2.1). Many of these have been incorporated into the alternatives considered for analysis in this EIS (Section 2.4). However, others have been dismissed from further consideration after careful review. These are described in the following sections:

2.5.1 Permanent Closures of Areas Previously Leased

Through the scoping process, a suggestion was put forward that certain areas of the Beaufort and Chukchi Seas should be permanently closed to oil and gas leasing due to environmental sensitivity**.** The appropriate mechanism for permanently excluding areas from seismic exploration and exploratory drilling activities is during the leasing process; identifying areas that are to be excluded from leasing. Areas that have been leased by BOEMRE in federal lease sales cannot legally be closed to seismic exploration and or exploratory drilling on a permanent basis unless the lessee agrees to relinquish the leases or compensation is mutually agreed upon by the federal government and the lessee.

NMFS and BOEMRE may consider temporary restrictions, such as time/area closures (see Alternative 4) and other mitigation measures to avoid or minimize adverse effects on marine mammals, other marine resources, and subsistence harvest activities through their respective authorities. If NMFS is able to find that the requested activity itself, or with the implementation of mitigation and monitoring measures, will have a negligible impact on affected marine mammal species or stocks and will not have an unmitigable adverse impact on affected marine mammal species or stocks for taking for subsistence uses, then, according to the MMPA, NMFS must issue the requested ITA.

2.5.2 Caps on Levels of Activities and /or Noise

It was suggested through scoping that there should be a cap established to limit the total number of oil and gas seismic and exploratory drilling activities that may occur in the planning area on a per season basis. The alternatives carried forward for analysis in the EIS include a range of exploration activities for assessment of potential effects from activity levels. The level of activity that can be authorized under the MMPA will be determined in conjunction with analysis of potential environmental consequences and mitigation measures. NMFS has to consider all requests for MMPA authorizations. After reviewing the requests, if NMFS is able to make the requisite findings, then the authorization must be issued.

Similarly, it was suggested that a sound cap or budget that limits the total amount of noise allowed per season should be considered as a mitigation measure. In the environmental analysis section, NMFS will consider the combined noise impacts from multiple surveys. Similarly, in the cumulative impact analysis, NMFS will consider the potential noise (and other types of) impacts from other known activities occurring in the action area. This information can be qualitatively considered in our analysis and potentially in the development of mitigation or monitoring measures. However, our current quantitative understanding of the likely impacts from noise is fairly limited to observed responses to a single sound source. While NMFS will qualitatively consider the potential impacts from exposure over time to multiple sound sources in this document – a "budget" implies a quantitative management of total sound that cannot currently be supported by the science.

2.5.3 Duplicative Surveys

A question was raised as to why restrictions could not be placed on companies that are repeating seismic surveys in the same geographic area. Based upon the OCS Lands Act and applicable regulations (30 CFR 250 and 30 CFR 251), BOEMRE does not have the discretion to require companies to share proprietary data, combine seismic programs, change lease terms, or prevent companies from acquiring data in the same geographic area. The agency does not have the authority to deny seismic permits simply on the grounds that they are duplicative – meaning the acquisition of the exact same data using the exact same equipment and technology in the exact same location. To improve data quality and imaging in the same area, surveys have been shot in different orientations, shot using different cable lengths, using new wide azimuth techniques, using multi component sensors, just to name a few. Some improvements resulted in deeper imaging, others in better imaging. Also, all seismic surveys are not the same, even when the exact equipment and technology is being used. Variances in the use of the exact same equipment and technology provide different data sets that have the potential to produce information to assist in subsequent exploration.

However, NMFS and BOEMRE are both committed to supporting the reduction of unnecessary sound in the water. BOEMRE is currently gathering information to describe the degree to which truly duplicative surveys have been conducted in the past. Once the details of past occurrence of this are better understood, BOEMRE will be in a better position to develop ways of tracking, and recommend means of minimizing, the occurrence of duplicative surveys.

2.5.4 Zero Discharge

Through the scoping process, a suggestion was put forward that "zero discharge" practices should be implemented to eliminate discharges of waste to the marine environment. Currently, "zero discharge" refers to the voluntary proposal by one oil company to manage five specific waste streams within its lease blocks in Camden Bay by~~practices of~~:

1) collecting sanitary waste, bilge water, ballast water, and domestic waste (*i.e.*- gray water) on working ships and/or support vessels, and subsequently transporting those waste materials for disposal out of the activity area, and

2) off-site disposal of drill cuttings and drilling fluids collected after the well casing is set.

However, oil and gas exploration activities generate a wide range of waste materials in addition to those associated with the current "zero discharge" proposal~~practices~~ by Shell Oil (Table 2.3).

~~All of the waste materials affected by "zero discharge" practices in the Beaufort and Chukchi Seas are regulated by the EPA under the National Pollutant Discharge Elimination System (NPDES) General Permit AKG-28-0000 (EPA 2006). In addition to drill cuttings, drilling fluids, sanitary waste, bilge water, ballast water, and domestic waste, which are affected by current~~

~~Table 2.3. Discharge Types~~

~~Discharge Types~~	~~Regulated under the NPDES Arctic General Permit (EPA)~~	~~Included in current "zero discharge" practices~~	~~Subject of Additional Mitigation Measures~~
~~Drill Cuttings~~	~~X~~	~~X~~	~~X~~
~~Drilling Fluids~~	~~X~~	~~X~~	~~X~~
~~Deck Drainage~~	~~X~~		
~~Sanitary Waste~~	~~X~~	~~X~~	~~X~~
~~Domestic Waste~~	~~X~~	~~X~~	~~X~~
~~Desalination Wastes~~	~~X~~		
~~Blowout Preventer Fluid~~	~~X~~		
~~Boiler Blowdown~~	~~X~~		
~~Fire Control System Water~~	~~X~~		
~~Cooling Water~~	~~X~~		
~~Ballast Water~~	~~X~~	~~X~~	~~X~~
~~Bilge Water~~	~~X~~	~~X~~	~~X~~
~~Excess Cement~~	~~X~~		
~~Test Fluids~~	~~X~~		
~~Cuttings at Seafloor~~	~~X~~		

Comment [JCurtis20]: (Per D. Soderlund) Also note that the NSB and other advocates for this practice reference Norwegian regulations, which we understand are currently being amended to eliminate the "zero discharge" principle for the Barents Sea. Furthermore, "zero discharge" in the Norwegian rules is "zero discharge of **harmful** contaminants".

Comment [JCurtis21]: The way the concept of zero discharge is presented here is a bit confusing. Is the assumption that the scoping comment was referring to the Shell zero discharge proposal, or did the commenter mean zero discharge of all wastewater discharges? This should be clarified.

Comment [HS22]: This is not yet a "practice", but a proposal by one oil company for its specific lease blocks in Camden Bay. Please note the same proposal does not apply to Shell's lease blocks in Harrison Bay, or the Chukchi Sea.

Comment [HS23]: This is not an accurate statement. Under the existing Arctic NPDES general permit, EPA does not "regulate" zero discharge. The current "zero discharge" proposal put on the table by Shell is an independent and voluntary agreement between Shell and the North Slope Borough.

Comment [HS24]: This table is inaccurate and not reflective of the Arctic GP requirements.

~~"zero discharge" practices, the~~The NPDES Arctic General Permit ~~also~~ regulates discharges of drilling muds and cuttings; deck drainage; sanitary wastes; domestic wastes; uncontaminated ballast water; bilge water; desalination unit wastes; blowout preventer fluid; boiler blowdown; fire control system test water; non-contact cooling water; excess cement slurry; and test fluids. The NPDES Arctic General permit includes additional provisions for discharges of drill cuttings and~~,~~ drilling muds, deck drainage, sanitary and domestic wastes, and test fluids~~, and cement at the seafloor (Table 2.3)~~.

The Arctic General Permit restricts the seasons of operation, discharge depths, and areas of operation, and has monitoring requirements and other conditions to ensure that ocean discharges are in compliance with EPA's Ocean Discharge Criteria for preventing unreasonable degradation of ocean waters (40 CFR Part 125, Subpart M). These specific criteria prevent significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities; threats to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms; and loss of aesthetic, recreational, scientific, or economic values, which are unreasonable in relation to the benefit derived from the discharge.

At the present time, partial or complete elimination of discharges resulting from oil and gas exploration is not technically practicable, and may introduce additional risks to the marine environment. Further consideration of this alternative in the EIS is not considered practicable or enforceable. NMFS will consider as additional mitigation measures the implementation of currently available techniques to limit discharge of specific wastes that may potentially impact marine mammals or marine mammal habitat.

Comment [HS25]: Is this also true for partial elimination of discharges?

Comment [HS26]: What would this be based on? EPA's ODCE or some other analysis? What happens if the two federal agencies' decisions are not in agreement?

Table 2.4. Summary of Alternatives

Element	Alternative 1 – No Action	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Level of Activity Authorized with ITAs	No ITAs issued	Up to three 2D/3D seismic surveys in the Beaufort Sea (Beaufort) and up to three in the Chukchi Sea (Chukchi) per year, including ice breaking if necessary	Up to five 2D/3D seismic surveys in the Beaufort and up to five in the Chukchi per year, including ice breaking as necessary	Same as Alternative 3	Same as Alternative 3
		Up to three site clearance and shallow hazards surveys in the Beaufort and up to three in the Chukchi per year	Up to five site clearance and shallow hazards surveys in the Beaufort and up to five in the Chukchi per year	Same as Alternative 3	Same as Alternative 3
		One exploratory drilling program in the Beaufort and one in the Chukchi per year, including ice breaking if necessary	Up to two exploratory drilling programs in the Beaufort and up to two in the Chukchi, including ice breaking as necessary	Same as Alternative 3	Same as Alternative 3
Required Standard Mitigation Measures	None needed	All (as described in Section 2.4.6)	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
Additional Mitigation Measures	None needed	Full range of those measures described in Section 2.4.7.	Same as Alternative 2	Same as Alternative 2	Same as Alternative 2
				Additional required time/area closures for: Camden Bay Barrow Canyon Hannah Shoal Kasegaluk Lagoon/ Ledyard Bay Critical Habitat Unit	Additional Mitigation Measures that focus on the use of alternative technologies that augment or replace traditional airgun-based seismic exploration activities.

APPENDIX XX: STANDARD AND ADDITIONAL MITIGATION MEASURES ADRESSING IMPACTS TO MARINE MAMMALS AND SUBSISTENCE ACTIVITIES

Required Standard Mitigation Measures

The following mitigation measures (and the identified mitigation monitoring needed to support them) are planned to be included as requirements under every ITA issued for the type of activity identified (DS=Deep Seismic, HRS=High Resolution Seismic, D=Drilling, IB=Icebreaking, or All).

a) Detection-based measures intended to reduce near-array acoustic exposures and impacts on marine mammals within a given distance of the source

- ***Establishment of 180 dB shutdown/power down radius for cetaceans and 190 dB shutdown/power down radius for pinnipeds (DS, HRS).***

NMFS has established acoustic thresholds that identify the received sound levels above which hearing impairment or other injury could potentially occur, which are 180 and 190 dB re 1 µPa (rms) for cetaceans and pinnipeds, respectively (NMFS 1995, 2000). The established 180- and 190-dB re 1 µPa (rms) criteria are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS before additional temporary threshold shift (TTS) measurements for marine mammals became available, one could not be certain that there would be no injurious effects, auditory or otherwise, to marine mammals. Separately, since the establishment of these acoustic criteria, NMFS has recommended and included shutdown/powerdown zones at the 180/190 dB rms isopleths as standard required mitigation measures in MMPA authorizations for seismic surveys. Typical language in past ITAs includes:

- Establish and monitor with trained Protected Species Observers (PSOs) a preliminary exclusion zone for cetaceans surrounding the airgun array on the source vessel where the received level would be 180 dB re 1 µPa rms. The radius for the zone will vary based on the airgun array used, water depth, and numerous other factors related to the water and seafloor properties. This distance will be established by modeling and/or a sound source verification test.
- Establish and monitor with trained PSOs a preliminary exclusion zone for pinnipeds surrounding the airgun array on the source vessel where the received level would be at or above 190 dB re 1 µPa rms. The radius for the zone will vary based on the airgun array used, water depth, and numerous other factors related to the water and seafloor properties. This distance will be established by modeling and/or a sound source verification test.
- Immediately power-down the seismic airgun array and/or other acoustic sources, whenever any cetaceans or walrus are sighted approaching close to or within the area delineated by the 180 dB-re 1 µPa rms, or pinnipeds or polar bears are sighted approaching close to or within the area delineated by the 190 dB re 1 µPa rms isopleth.
- If the power-down operation cannot reduce the received sound pressure level at the cetacean or pinniped to less than 180 dB or 190 dB, respectively, then the holder of

the ITA must immediately shutdown the seismic airgun array and/or other acoustic sources.

- Do not proceed with powering up the seismic airgun array unless the marine mammal exclusion zones are visible and no marine mammals are detected within the appropriate safety zones or until 15 minutes (for small odontocetes, pinnipeds) or a minimum of 30 minutes (for mysticetes) after there has been no further visual detection of the animal(s) within the exclusion zone, and the trained PSOs on duty are confident that no marine mammals remain within the appropriate exclusion zone.

- ***Specified ramp-up procedures for airgun arrays (DS, HRS).***

Ramp-up is the gradual introduction of sound to deter marine mammals from potentially damaging sound intensities and from approaching the exclusion zone. This technique involves the gradual increase (usually approximately 5-6 dB per 5-minute increment) in emitted sound levels, beginning with firing a single airgun and gradually adding airguns over a period of 20 to 40 minutes, until the desired operating level of the full array is obtained. Ramp-up procedures are instituted to allow any marine mammals in the vicinity of seismic operations to become aware of the noise source before it rises to potentially harmful levels and to leave the area. The 180- and 190-dB (rms) exclusion zones described in the previous measure are used for the ramp-up procedures as well. Typical language in past ITAs includes:

- Conduct a 30-minute period of marine mammal observations by at least two trained PSOs to verify that the exclusion zone is clear prior to commencing ramp-up at the commencement of seismic operations and at any time the airgun array has been shut down for a certain period of time. The period of shutdown requiring a full ramp-up is based on the size of the airgun array but is typically between 8 and 10 minutes.

- Do not commence ramp-up if the entire exclusion zones are not visible for at least 30 minutes prior to ramp-up in either daylight or nighttime and not commence ramp-up at night unless the seismic source has maintained a sound pressure level at the source of at least 180 dB re 1 pPa rms during the interruption of full seismic survey operations. If a sound source of at least 180 dB re 1 pPa rms has been maintained during the interruption of seismic operations, then the 30 minute pre-ramp-up visual survey is waived.

- Ramp-up the airgun arrays at no greater than 6 dB per 5-minute period starting with the smallest airgun in the array and then adding additional guns in sequence until the full array is firing if no marine mammals are observed in the safety zones and periods specified above. Ramp-up procedures should be used at the commencement of seismic operations and any time after the airgun array has been shut down for a certain period of time.

- ***PSOs required on all seismic source vessels and ice breakers (DS, HRS, IB).***

PSOs are a key component both for the purposes of implementing mitigation measures, such as shutdowns and ramp-ups, and for gathering information pursuant to the monitoring requirements of the ITA (latter addressed separately).. Some of the mitigation monitoring requirements in past ITAs include:

- The holder of the ITA must designate trained, NMFS-approved on-site individuals (PSOs) to be onboard the source vessel to conduct the visual monitoring programs required under this Authorization and to record the effects of seismic surveys and the resulting noise on marine mammals.
- To the extent possible, PSOs should be on duty for four consecutive hours or less, although more than-one four-hour shift per day is acceptable. PSOs will not work more than three shifts in a 24-hour period (i.e., 12 hours total per 24-hour period).
- Monitoring is to be conducted by the PSOs onboard the active seismic vessel, to (A) ensure that no marine mammals enter the appropriate exclusion zone whenever the seismic sources are on, and (B) to record marine mammal activity. At least two observers must be on watch the 30 minutes prior to full ramp up, during ramp ups, and for as much of the other operating hours as possible. At all other times, at least one observer must be on active watch (1) whenever the seismic source is operating during the daytime; (2) during any nighttime power-ups of the airguns; and (3) at night, whenever one or more power-down situations the preceding day were due to marine mammal presence.
- At all times, the crew must be instructed to keep watch for marine mammals. If any are sighted, the bridge watch-stander must immediately notify the MMO(s) on-watch. If a marine mammal is within or closely approaching its designated exclusion zone, the seismic acoustic sources must be immediately powered down or shutdown.
- Monitoring will consist of recording: (A) the species, group size, age/size/sex categories (if determinable), the general behavioral activity, heading (if consistent), bearing and distance from seismic vessel, sighting cue, behavioral pace, and apparent reaction of all marine mammals seen near the seismic vessel and/or its airgun array (e.g. none, avoidance, approach, paralleling, etc); (B) the time, location, heading, speed, and activity of the vessel (shooting or not), along with sea state, visibility, cloud cover and sun glare at (I) any time a marine mammal is sighted, (II) at the start and end of each watch, and (III) during a watch (whenever there is a change in one or more variable); and, (C) the identification of all vessels that are visible within 5 km (3.1 mi) of the seismic-vessel whenever a marine mammal is sighted, and the time observed, bearing, distance, heading, speed and activity of the other vessel(s).

b) Non-detection-based measures intended to more broadly lessen the severity of acoustic impacts on marine mammals or reduce overall numbers taken by acoustic source.

- ***Specified flight altitudes for all support aircraft except for take-off, landing, and emergency situations (All).***
  - Aircraft shall not operate below 1,500 ft (457 m) unless the aircraft is engaged in marine mammal monitoring, approaching, landing or taking off, or unless engaged in providing assistance to a whaler or in poor weather (low ceilings) or any other emergency situations. Aircraft engaged in marine mammal monitoring shall not operate below 1,500 ft (457 m) in areas of active subsistence use; such areas to be identified through communications with the Communication Centers.

- Except for airplanes engaged in marine mammal monitoring, aircraft shall use a flight path that keeps the aircraft at least five miles inland until the aircraft is directly (south) of its offshore destination, then at that point it shall fly directly (north) to its destination.
- Helicopters shall not hover or circle above groups of marine mammals or within 1,500 lateral ft (457 m) of such areas.

c) Measures intended to reduce/lessen non-acoustic impacts on marine mammals

- ***Specified procedures for changing vessel speed and/or direction to avoid collisions with marine mammals (All).***

General operation conditions include:

- Reduce vessel speed when within 274 m (900 ft) of whales and those vessels capable of steering around such groups should do so. Vessels may not be operated in such a way as to separate members of a group of whales from other members of the group.
- Avoid multiple changes in direction and speed when within 274 m (900 ft) of whales. In addition, operators should check the waters immediately adjacent to a vessel to ensure that no whales will be injured when the vessel's propellers (or screws) are engaged.
- Not operate support vessels (including small boats), to the extent that they are being used, at a speed that would make collisions with whales likely.
- When weather conditions require, such as when visibility drops, adjust vessel speed accordingly to avoid the likelihood of injury to whales.

- ***Notification of lost equipment that could pose a danger to marine mammals (All).***
  - The operator shall notify BOEMRE, NMFS, and the U.S. Fish and Wildlife Service in the event of any loss of cable, streamer, or other equipment that could pose a danger to marine mammals and other wildlife resources.
- ***Operators are required to prepare for oil spill response (All).***
  - Each operator is required to prepare an oil spill response plan (OSRP) for any facilities seaward of the coastline. In the OSRP, the operator must include an emergency response action plan, a worst-case-discharge (WCD) scenario, an inventory of response equipment to support a WCD response, contractual agreements with oil spill removal organizations (OSRO) who will provide response services, a dispersant-use plan, an in situ-burning plan, and a training and response drills plan.
  - In developing the WCD scenario, operators are required to conduct an appropriate trajectory analysis for the area where the facility will be located. This analysis must identify onshore and offshore areas that a discharge potentially could impact and further identify resources of special economic or environmental concern that may be present. The operator must describe what strategies would be used to protect these areas and resources.

- Operators may be required to stage spill response equipment near areas of concern to facilitate more rapid deployment to protect critical resources and limit exposure to oil.

- ***Operators are required to limit discharges and recycle drilling muds to the extent practicable (D).***
  - Operators are required to recycle drilling muds (e.g., use those muds on multiple wells) to the extent practicable based on operational considerations to reduce discharges.
  - Operators are required to limit discharges of cement slurry, drainage waters, and domestic wastewaters.
  - Operators are required to limit discharge of air pollutants, such as nitrogen dioxide, sulfur dioxide, and carbon monoxide using best available control technology.

Comment [HS27]: How would operators demonstrate compliance with these requirements?

d) Measures intended to reduce/lessen impacts to subsistence uses

Comment [ACR28]: Input from AEWC, ABWC, and ISC requested on this section.

- ***Shutdown of exploration activities occurring in the Beaufort Sea (east of a certain line) from on or around August 25 until the close of the Nuiqsut (Cross Island) and Kaktovik fall bowhead whale hunts (All).***
  - No geophysical activity from the Canadian Border to the Canning River (146 deg. 4 min. W) from August 25 to close of the fall bowhead whale hunt in Kaktovik and Nuiqsut (Cross Island).
  - The bowhead whale subsistence hunt will be considered closed for a particular village when the village Whaling Captains' Association declares the hunt ended or the village quota has been exhausted (as announced by the village Whaling Captains' Association or the Alaska Eskimo Whaling Commission [AEWC]), whichever occurs earlier.
  - From August 10 to August 25, industry participants will communicate and collaborate with AEWC on any planned vessel movement in and around Kaktovik and Cross Island to avoid impacts to whale hunt.
  - From Pt. Storkerson (~148 deg. 42 min. W) to Thetis Island (~150 deg. 10.2 min. W);
    - Inside the Barrier Islands: No geophysical activity prior to August 5. Geophysical activity is allowed from August 5 until completion of operations. Geophysical activity allowed in this area after August 25 shall include a source array of no more than 12 airguns, a source layout no greater than 8 m x 6 m (26.2 x 19.7 ft), and a single source volume no greater than 880 in^3 (14.4 liters).
    - Outside the Barrier Islands: No geophysical activity from August 25 to close of fall bowhead whale hunting in Nuiqsut. Geophysical activity is allowed at all other times.
  - From Canning River (~146 deg. 4 min. W) to Pt. Storkerson (~148 deg. 42 min. W), no geophysical activity from August 25 to the close of bowhead whale subsistence hunting in Nuiqsut.

- Around Barrow, no geophysical activity from Pitt Point on the east side of Smith Bay (~152 deg. 15 min. W) to a location about half way between Barrow and Peard Bay (~157 deg. 20 min. W) from September 15 to the close of the fall bowhead whale hunt in Barrow.
- Industry participants will contact the whaling captains' associations of Wainwright, Point Lay, and Point Hope to determine if the village is planning to participate in a fall whale hunt. If the village whaling captains' indicate that they plan to participate in the fall whale hunt, before September 15th, no more than two geophysical activities employing airguns will occur at any one time within 48.3 km (30 mi) of any point along the Chukchi Sea coast until the close of the fall bowhead whale hunt.

- ***Establishment of Communication Centers in subsistence communities to address potential interference with marine mammal hunts on a real-time basis throughout the season (All).***

Comment [ACR29]: Input from AEWC, ABWC, and ISC requested on this section.

To address potential interference with marine mammal hunts on a real-time basis, exploration companies have been required to participate in the establishment and interaction with Communication Centers in affected subsistence communities. The Communication Centers are to be operated on a 24-hour basis during the fall bowhead whale hunt.

- Upon notification by a Communication Center operator of an at-sea emergency, the holder of the ITA shall provide such assistance as necessary to prevent the loss of life, if conditions allow the holder of the ITA to safely do so.
- Upon request for emergency assistance made by a subsistence whale hunting organization, or by a member of such an organization, in order to prevent the loss of a whale, the holder of the ITA shall assist towing of a whale taken in a traditional subsistence whale hunt, if conditions allow the holder of the ITA to safely do so.
- Following completion of 2009 Chukchi Sea geophysical activities, and prior to the 2010 Pre-Season Introduction Meetings, the Holder of the ITA and other Chukchi Sea Industry Participants, if requested by the AEWC or the Whaling Captain's Association of each village, will host a meeting in each of the following villages: Wainwright, Point Lay, Point Hope, and Barrow (or a joint meeting of the whaling captains from all these villages if the whaling captains agree to a joint meeting) to review the results of the 2009 operations and to discuss any concerns residents of those villages might have regarding the operations. The meetings will include the PSOs Inupiat Communicators stationed on the Authorization holder's vessels in the Chukchi Sea. The Chairman and Executive Director of the AEWC will be invited to attend the meeting(s).
- The Plan of Cooperation (as required by NMFS implementing regulations at 50 CFR 216.104(a)(12)) outlining the steps that will be taken to cooperate and communicate with the native communities to ensure the availability of marine mammals for subsistence uses must be implemented.

- ***Required flight altitudes and paths for all support aircraft in areas where subsistence occurs, except during take-off, landing, and emergency situations (All).***

Vessels and aircraft shall avoid concentrations or groups of whales. Operators shall, at all times, conduct their activities at a maximum distance from such concentrations of whales.

- Aircraft shall not operate below 1,500 ft (457 m) unless the aircraft is engaged in marine mammal monitoring, approaching, landing or taking off, or unless engaged in providing assistance to a whaler or in poor weather (low ceilings) or any other emergency situations.
- Aircraft engaged in marine mammal monitoring shall not operate below 1,500 ft (457 m) in areas of active whaling; such areas to be identified through communications with the Communication Centers.
- Except for airplanes engaged in marine mammal monitoring, aircraft shall use a flight path that keeps the aircraft at least five miles inland until the aircraft is directly (south) of its offshore destination, then at that point it shall fly directly (north) to its destination.
- When weather conditions do not allow a 1,000 ft (305 m) flying altitude, such as during severe storms or when cloud cover is low, aircraft may be operated below the 1,000 ft (305 m) altitude. However, when aircraft are operated at altitudes below 1,000 ft (305 m) because of weather conditions, the operator must avoid known whale concentration areas and should take precautions to avoid flying directly over or within 1,500 yards (1,372 m) of groups of whales.

Additional Mitigation Measures

The following mitigation measures (and mitigation monitoring needed to support them) will be comprehensively evaluated in Chapter 4 and may be required by NMFS in ITAs to make the necessary findings under the MMPA for the type of activity identified

(DS=Deep Seismic, HRS=High Resolution Seismic, D=Drilling, IB=Icebreaking, or All).

a) Detection-based measures intended to reduce near-array acoustic exposures and impacts on marine mammals within a given distance of the source

- ***Sound source verification tests for sound sources and vessels at the start of the season (All).***

Before conducting the activity, the operators shall conduct sound source verification (SSV) tests to verify the radii of the safety and monitoring zones within real-time conditions in the field, providing for more accurate radii to be used. When moving an operation into a new area, the operator shall re-verify the new radii of the exclusion zones. The purpose of this mitigation measure is to establish and monitor more accurate safety zones based on empirical measurements, as compared to the zones based on modeling and extrapolation from different datasets. Using a hydrophone system, the vessel operator is required to conduct SSV tests for all airgun arrays and vessels and, at a minimum, report the following results to NMFS within five days of completing the test:

  - The empirical distances from the airgun array and other acoustic sources utilized during the effectiveness of the ITA to broadband received levels of 190 dB down to 120 dB in 10 dB increments, re 1 uPa rms, and the radiated sounds vs. distance from the source vessel.
  - Measurements are to be made at the beginning of the survey for locations not previously modeled in the Arctic Seas.

- ***Measures to assess efficacy and improve detection capabilities in low visibility situations (e.g. Forward Looking Infrared [FLIR] imaging devices, 360° thermal imaging devices) (DS, HRS, IB).***
  - All PSOs could be provided with and use appropriate night-vision devices, Big Eyes, and reticulated and/or laser range finding binoculars in order to detect marine mammals within the Exclusion Zone.
- ***Limitation of activities in situations where visibility is low***
- ***Measures to increase detection probability for real-time mitigation (e.g. to maintain 180 dB shutdown zones), such as passive and active acoustic monitoring (DS, HRS, IB).***
- ***Assess and enhance monitoring protocols and mitigation shutdown zones to minimize impacts in specific biologic situations (e.g cow/calf groups and feeding or resting aggregations) (All).***

Some characteristic mitigation language that has been used in past ITAs for these measures include:

- For seismic activities (including shallow hazards and site clearance and other marine surveys where active acoustic sources will be employed) in the Beaufort Sea after August 25, a 120-dB monitoring zone for bowhead whales will be established and monitored for the next 24 hours if four or more bowhead whale cow/calf pairs are observed at the surface during an aerial monitoring program within the area where an ensonified 120-dB zone around the vessel's track is projected. To the extent practicable, such monitoring should focus on areas upstream (eastward) of the bowhead migration. No seismic surveying shall occur within the 120-dB safety zone around the area where these whale cow-calf pairs were observed, until two consecutive surveys (aerial or vessel) indicate they are no longer present within the 120-dB safety zone of seismic-surveying operations.
- A 160-dB vessel monitoring zone for bowhead and gray whales will be established and monitored in the Chukchi Sea and after August 25 in the Beaufort Sea during all seismic surveys. Whenever an aggregation of bowhead whales or gray whales (12 or more whales of any age/sex class that appear to be engaged in a non-migratory, significant biological behavior (e.g., feeding, socializing)) are observed during an aerial or vessel monitoring program within the 160-dB safety zone around the seismic activity, the seismic operation will not commence or will shut down, until two consecutive surveys (aerial or vessel) indicate they are no longer present within the 160-dB safety zone of seismic-surveying operations.

b) Non-detection-based measures intended to more broadly lessen the severity of acoustic impacts on marine mammals or reduce overall numbers taken by acoustic source

- ***Temporal/spatial limitations to minimize impacts in particular important habitats, including Camden Bay, Barrow Canyon, Hannah Shoal, and Kasegaluk Lagoon/Ledyard Bay Critical Habitat Unit (All).***
  - Camden Bay: Limitations to be developed, minimizing surface vessel and aircraft disturbance of feeding and resting whales
  - Barrow Canyon: Limitations to be developed, minimizing surface vessel and aircraft disturbance of feeding and resting whales
  - Hannah Shoal: Limitations to be developed, minimizing surface vessel and aircraft disturbance of feeding and resting marine mammals (gray whales, walrus, spotted seals)
  - Ledyard Bay Critical Habitat Unit: Except for emergencies or human/navigation safety, surface vessels associated with seismic survey operations shall avoid travel within the Unit between July 1 and November 15.
  - Ledyard Bay Critical Habitat Unit: To the maximum extent practicable, aircraft supporting seismic survey operations shall avoid operating below 1,500 ft (457 m) over the Unit between July 1 and November 15.
  - Ledyard Bay Critical Habitat Unit: Vessel travel within the Unit and altitude deviations by aircraft over the Unit for emergencies or human safety shall be reported within 24 hours to BOEMRE.

- ***Limits to overlap and orientation in time and space of ensonified zone of authorized projects (All).***
  - Source vessels would not operate airguns within 15 mi (24 km) of one another (standard BOEMRE measure for operational fidelity).
  - Source vessels would not operate airguns within 90 mi (145 km) of one another. This distance is intended to be three times the distance that bowheads react to airguns (30 mi [48 km]) so that between any two operations, there would be a corridor of some width through which bowheads could travel and not be exposed to noise at harmful levels.
- ***NMFS or BOEMRE restricting number of surveys (of same level of detail) that can be conducted in the same area in a given amount of time (i.e., to avoid needless collection of identical data (All).***
  - Require industry to organize a way to interact with one another to identify when and if duplicative surveys are likely to occur (survey type to gather same type of data within X years) and outline efforts to avoid or describe justification.

c) Measures intended to reduce/lessen non-acoustic impacts on marine mammals

- ***Vessels and aircraft should avoid concentrations of groups of walruses and polar bears (All).***
  - Seismic survey and associated support vessels shall observe a 0.5-mi safety radius around Pacific walrus groups hauled out onto land or ice.
  - Vessels must reduce speed when walruses are observed in the water. Vessels capable of steering around these animals must do so. Vessels may not be operated in such a manner as to separate members of a group of walruses from other members of a group. Vessels should avoid multiple changes in direction and speed when walruses are present.
  - Under no circumstances, other than an emergency, should aircraft be operated at an altitude lower than 1,500 ft (457 m) when within 0.5 mi (0.8 km) of walrus groups.
  - Helicopters may not hover or circle above such areas or within 2,500 lateral ft (762 m) of such areas.
  - Seismic survey operators shall adhere to any mitigation measures identified by the USFWS to protect polar bears from being harassed and/or injured.
  - Vessels must reduce speed when polar bears are observed in the water. Vessels capable of steering around these animals must do so. Vessels may not be operated in such a manner as to separate members of a group of polar bears from other members of a group. Vessels should avoid multiple changes in direction and speed when polar bears are present.
  - Currently, proposed polar bear critical habitat mitigation includes a 1.6 km (1 mi) no disturbance zone around the barrier islands, and sea ice habitat.

- ***Requirements to ensure zero discharge, or reduced discharge, of the specific discharge streams identified with potential impacts to marine mammals or marine mammal habitat (All).***
  - Drill cuttings
  - Drilling fluids
  - Sanitary waste
  - Bilge water,
  - Ballast water
  - Domestic waste (i.e.- gray water)

Comment [HS30]: Why these particular waste streams? Just because this is Shell's proposal for very specific lease locations does not necessary mean they should be considered by NMFS.

Comment [ACR31]: Input from AEWC, ABWC, and ISC requested on this section.

d) Measures intended to reduce/lessen impacts to subsistence uses

- ***No transit of exploration vessels into the Chukchi Sea prior to July 1 (All).***
  - Any vessel conducting geophysical work in the Chukchi should remain as far offshore as weather and ice conditions allow and, at all times, at least 8.05 km (5 mi) offshore during transit.
  - Geophysical activity shall not be conducted within 96.56 km (60 mi) of any point on the Chukchi coast.
- ***Shutdown of exploration activities in the Beaufort Sea for the Nuiqsut (Cross Island) and Kaktovik bowhead whale hunts based on real-time reporting of whale presence and hunting activity rather than a fixed date (All).***
- ***Shutdown of exploration activities in the Chukchi Sea for the Barrow (the area circumscribed from the mouth of Tuapaktushak Creek due north to the coastal zone boundary, to Cape Halkett due east to the coastal zone boundary) and Wainwright (the area circumscribed from Point Franklin due north to the coastal zone boundary, to the Kuk River mouth due west to the coastal zone boundary) bowhead whale hunts based on real-time reporting of whale presence and hunting activity rather than a fixed date (All).***
- ***Transit restrictions into the Chukchi Sea modified to allow off-shore travel under certain conditions (e.g. 32 km [20 mi] from the coast) if beluga whale and other marine mammal hunts would not be affected (All).***
- ***Pre-set time/area restrictions to avoid hunting activities other than the Kaktovik and Nuiqsut (Cross Island) bowhead whale hunts (All).***
- ***Shutdown safety zone if whaling or sealing vessel approaches an industry operation (All).***

e) Additional Reporting Requirements

- ***Reporting exact tracklines of vessels***
- ***Inclusion of raw acoustic data***

CHAPTER 1 – PURPOSE AND NEED

This chapter establishes the purpose and need for the Effects of Oil and Gas Activities in the Arctic Ocean Draft Environmental Impact Statement (EIS). It also contains background information on previous planning processes related to this EIS. The information contained in the following sections is intended to provide a broad analysis of management alternatives and help set the stage for informed decision-making for future management actions. The overall organization of the document is outlined in Section 1.9.

1.1 Background

Pursuant to the National Environmental Policy Act (NEPA), the U.S. Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) and the Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) formerly known as the Minerals Management Service (MMS) have prepared an EIS to describe and analyze the potential impacts to the human environment related to oil and gas industry offshore exploration activities (e.g., seismic surveys and exploratory drilling activities) in the U.S. Beaufort and Chukchi Seas, Alaska. The MMS was renamed as the BOEMRE on June 18, 2010, by order of the Secretary of the Interior (Order No. 3302). The designations for MMS and BOEMRE are used interchangeably below depending on the context.

On April 6, 2007, NMFS and MMS published a Notice of Availability (NOA) for a Draft Programmatic Environmental Impact Statement (DPEIS) (72 *Federal Register* [FR] 17117). The DPEIS assessed the impacts of MMS' issuance of permits and authorizations under the Outer Continental Shelf Lands Act (OCS Lands Act) for seismic surveys in the U.S. Chukchi and Beaufort Seas off the coast of Alaska, and NMFS' issuance of incidental take authorizations (ITAs) under Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) to take marine mammals incidental to conducting those permitted activities.

The scope and effects of the seismic survey activities analyzed in the DPEIS were based on the best available information at the time. However, since 2007, new information that alters the scope, set of alternatives, and analyses in the DPEIS has become available (e.g., scientific study results, changes in projections of level and types of offshore exploration activities). In addition, NMFS determined that an EIS must also address the potential effects of exploratory drilling, which was not addressed in the 2007 DPEIS. Therefore, MMS and NMFS filed a Notice of Withdrawal of the DPEIS on October 28, 2009 (74 FR 55539) and announced their decision to prepare a new EIS, the *Effects of Oil and Gas Activities in the Arctic Ocean*. A Notice of Intent (NOI) to prepare the new EIS was announced in the *Federal Register* on February 8, 2010 (75 FR 6175). The purpose of the NOI was to announce the preparation of a new EIS that would analyze the potential effects of both geophysical surveys and exploratory drilling, address cumulative effects over a longer time frame, consider a range of more reasonable alternatives consistent with the agencies' statutory mandates, and analyze the range of practicable mitigation and monitoring measures for protecting marine mammals and their availability for

subsistence uses. The Notice asked for public comments and stated that MMS would be a cooperating agency on this EIS.

This EIS will address anticipated levels of geological and geophysical activities in the U.S. Beaufort and Chukchi Seas, Alaska, including: 1) deep penetration and high-resolution seismic surveys as permitted under 30 Code of Federal Regulations (CFR) Parts 251 and 280 regulations; and 2) exploratory drilling, deep penetration surveys, and shallow hazards surveys as authorized under 30 CFR Part 250 regulations as ancillary activities. Geological and Geophysical (G&G) permitted operations are conducted on or off lease or on another lease holder's area, by the lessee or a third party under 30 CFR 251 or 280. Ancillary and exploratory drilling activities are conducted on-lease under 30 CFR 250. Both deep penetration seismic and high resolution geophysical activities can be performed as either G&G permitted or ancillary activities. To avoid confusion regarding the terminology associated with geological and geophysical data collection, the oil and gas exploration activities that will be assessed and evaluated throughout the EIS for potential environmental impacts are categorized as:

- **Deep penetration geophysical surveys** (e.g., seismic surveys, including open-water, towed streamer 2-dimensional [2D] or 3-dimensional [3D] surveys, in-ice towed streamer 2D surveys, on-ice 2D or 3D surveys or Ocean-Bottom-Cable [OBC] surveys; gravity and gradiometry surveys; and controlled source electromagnetic surveys [CSEM]). On average, data from deep penetration geophysical surveys provide imagery to a depth of approximately 10,000 meters (m) (6.2 miles [mi]) below the seafloor. However, penetration may be deeper or shallower depending on the equipment used. Companies can submit requests to conduct these types of deep penetration surveys to BOEMRE for approval under the regulations found at 30 CFR 250, 30 CFR 251, and 30 CFR 280.
- **Shallow hazards surveys** (also called high-resolution or site clearance surveys) and geological studies are considered ancillary activities when conducted under the 30 CFR 250 regulations. These types of activities either use acoustic sources to provide imagery of the sub-seafloor to a depth of less than 1,500 m (0.9 mi) or sediment sampling devices. A suite of instruments will be used depending upon the targeted information needed. Standard equipment for shallow hazards surveys includes: single beam and multibeam echosounders, side scan sonar, magnetometer, subbottom profiler, and other seismic sources. Sediment sampling devices include grab samplers and coring equipment. Shallow hazards activities can also be authorized under the regulations found at 30 CFR 251 and 30 CFR 280.
- **Exploratory drilling** – Any drilling conducted by a lessee for the purpose of searching for commercial quantities of oil, gas, and sulfur authorized under 30 CFR 250.

The sound levels and frequencies associated with each of these activities are governed by the specific equipment being used. This will be discussed in Section XXX.

The environmental effects associated with deep penetration geophysical surveys, shallow hazards surveys, and exploratory drilling activities, as well as current and proposed mitigation measures, will also be evaluated. This will allow NMFS and BOEMRE to comprehensively assess activities that may occur in a given season in advance of receiving applications to authorize incidental takes of marine mammals associated with deep penetration geophysical surveys, shallow hazards, and exploratory drilling activities. The analysis will evaluate the direct, indirect and cumulative impacts that could occur under each of the proposed alternatives and considers the best available science regarding all of the resources potentially impacted. Moreover, the EIS will include an analysis of potential mitigation and monitoring measures that could be included in future authorizations to allow the issuance of multiple MMPA ITAs during a given season.

The EIS will assist NMFS and BOEMRE in carrying out other statutory responsibilities and serve to support future decisions relating to the agencies' roles in authorizing or permitting deep penetration geophysical surveys, shallow hazards surveys, and exploratory drilling activities or incidental take of marine mammals (e.g., assessing environmental impacts on listed species under the Endangered Species Act [Section 7 consultation] and effects of the proposed action on essential fish habitat [EFH] under the Magnuson-Stevens Fishery Conservation and Management Act). BOEMRE will coordinate closely with NMFS and the U.S. Fish and Wildlife Service (USFWS) to ensure compliance with these statutes and, where needed, will modify permit conditions or lease operations to meet the requirement of any Endangered Species Act (ESA) or MMPA authorization.

The EIS will also assist NMFS and BOEMRE in performing NEPA evaluations on MMPA ITAs and G&G and exploratory drilling activities, respectively. NMFS intends to use this EIS as the required NEPA documentation for the issuance of ITAs for Arctic oil and gas exploration activities. However, if necessary, NMFS may tier from this EIS to support future Arctic MMPA oil and gas permit decisions if such activities fall outside the scope of this EIS BOEMRE intends to conduct site-specific NEPA analyses that either tier from this EIS or incorporate this EIS by reference.

Comment [HS1]: This sentence is confusing. Missing an "and" between the words "decisions" and "if"?

NMFS Statutory and Regulatory Mandates Relevant to EIS Scope of Analysis

Sections 101(a)(5)(A) and (D) of the MMPA (16 United States Code [U.S.C.] §1361 *et seq.*) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of proposed authorization is provided to the public for review. Authorization for incidental takings shall be granted if:

- NMFS finds that the taking will have a negligible impact on the species or stock(s);
- NMFS finds that the taking will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant); and
- the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings are set forth.

NMFS has defined "negligible impact" in 50 CFR §216.103 as "... an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival." Additionally, NMFS has defined "unmitigable adverse impact" in 50 CFR §216.103 as:

> …an impact resulting from the specified activity: (1) That is likely to reduce the availability of the species to a level insufficient for a harvest to meet subsistence needs by: (i) Causing the marine mammals to abandon or avoid hunting areas; (ii) Directly displacing subsistence users; or (iii) Placing physical barriers between the marine mammals and the subsistence hunters; and (2) That cannot be sufficiently mitigated by other measures to increase the availability of marine mammals to allow subsistence needs to be met.

The geographic scope of exploration activities requiring compliance with the MMPA includes both federal and state marine waters.

Comment [JCurtis2]: This concept needs to continue through the later discussion of regulatory roles and responsibilities (eg. the State of Alaska is currently scheduled to assume Phase IV APDES delegation in Oct. 2012, but only EPA requirements are contemplated).

BOEMRE Statutory and Regulatory Mandates Relevant to EIS Scope of Analysis

The Outer Continental Shelf Lands Act, 43 U.S.C. §§ 1331 *et seq.* (OCS Lands Act) prescribes a four stage process for development of offshore federal mineral resources: (1) a 5-year oil and gas leasing program; (2) lease sales; (3) exploration pursuant to exploration plans; and (4) development and production plans. Environmental reviews are conducted for each of these stages.

The OCS Lands Act directs the BOEMRE to oversee the "expeditious and orderly development" of OCS resources subject to environmental safeguards (43 U.S.C. §§ 1332(3), (6), 1334(a)(7)). Critical to the potential development of OCS resources is the ability to gather geological and geophysical data on the resource potential of the OCS. The BOEMRE, which has rights to all data collected under the OCS Lands Act and implementing regulations, needs the best available data to ensure that the Federal government, i.e. the American people, receives fair market value for leased resources. The OCS Lands Act authorizes BOEMRE to issue G&G, ancillary, and exploration permits or notice approvals for these and related purposes and requires that the data and information collected be obtained in a technically safe and environmentally sound manner (43 U.S.C. § 1340(a)(1), (g); 30 CFR § 250.102(e), 250.223; 250.247(a); 30 CFR § 251.2(b), 251.4, 251.6; 30 CFR § 280.2(b), 280.20). BOEMRE includes measures in permits to ensure that authorized activities do not adversely affect either human safety or marine resources (30 CFR Parts 250, 251, 280).

BOEMRE regulations (30 CFR Part 251 and Part 280) specifically state that G&G activities cannot:

- interfere with or endanger operations under any lease or right-of-way, easement, right-of-use, Notice, or permit issued or maintained under the OCS Lands Act;
- cause harm or damage to life (including fish and other aquatic life), property, or to the marine, coastal, or human environment;

- cause harm or damage to any mineral resource (in areas leased or not leased);
- cause pollution;
- create hazardous or unsafe conditions; or
- unreasonably interfere with or cause harm to other uses of the area.

In addition to assessing and mitigating for potential environmental impacts in advance of exploratory drilling operations, BOEMRE also reviews acquired shallow hazards data and determines the location of resources of concern (e.g., archaeological or sensitive benthic resources) to ensure that appropriate measures can be implemented to reduce the potential for adverse impacts. Where this potential exists, operators/lessees are required to proceed in one of the following three ways:

1. Employ specific operational procedures to protect the resources of concern;
2. Adjust the location of the proposed activity(ies) to a distance necessary to prevent disturbance of the resource(s) of concern; or
3. Perform additional investigations to establish that the potential resources of concern do not exist at the proposed site or will not be adversely affected by the proposed activity.

Pursuant to 30 CFR § 251.4, a G&G permit must be obtained from BOEMRE to conduct G&G exploration for oil, gas, and sulphur resources when operations occur on unleased lands or on lands leased to a third party. Separate permits must be obtained for other G&G explorations for mineral resources (30 CFR Part 280). Ancillary activities are regulated under 30 CFR Part 250, which states that a notice must be submitted before conducting G&G data collection pursuant to a lease issued or maintained under the OCS Lands Act (30 CFR § 250.208).

Recent Guidance on Offshore Oil and Gas Development

Government Accountability Office

In March 2010, a Government Accountability Office (GAO) report entitled *"OFFSHORE OIL AND GAS DEVELOPMENT: Additional Guidance Would Help Strengthen the Minerals Management Service's Assessment of Environmental Impacts in the North Aleutian Basin*" made two executive recommendations to help MMS meet federal requirements in assessing environmental impacts of offshore oil and gas development in the Alaska Region. The GAO advised that the Secretary of the Interior direct MMS "to strengthen the agency's NEPA procedures and ensure implementation of its agency wide April 2008 information-sharing policy."

The first GAO recommendation was to develop a comprehensive handbook that provides guidance on how to implement NEPA. This guidance will be periodically updated and revised as necessary, and will detail procedures for conducting and documenting NEPA-required analyses, including how determinations of significance are to be made and how scientific findings are to be reviewed. The Secretary of the Interior has directed BOEMRE to complete the NEPA handbook by December 31, 2010. However, a draft of the guidebook was provided to the Region in June 2010 to provide interim guidance for BOEMRE Alaska Region personnel when writing NEPA documents.

Comment [CAN3]: Need to get a new deadline from BOEMRE on this.

The second recommendation requested MMS take appropriate steps to ensure that the Alaska Region follows the policy for sharing or otherwise making information, including proprietary information, available to all staff involved in the technical or environmental review of that information. This recommendation was addressed by the BOEMRE Alaska Regional Director when he issued a directive for information sharing to the Alaska Region in June 2010. Among other things, the directive detailed procedures for processing and accessing proprietary information and supervisory consultation with subject matter experts when finalizing management revisions to ensure the scientific quality of the analysis. This directive closed the action item and implemented the recommendation identified by GAO.

Council on Environmental Quality
The BOEMRE is committed to using the guideposts put forth in The Council on Environmental Quality's (CEQ) report, entitled "*Report Regarding the Minerals Management Service's National Environmental Policy Act Policies, Practices, and Procedures as They Relate to Outer Continental Shelf Oil and Gas Exploration and Development*" dated August 16, 2010. The guideposts provide recommendations with respect to: 1) tiering and site-specific analysis; 2) transparency, public accountability, and sound decision making; 3) categorical exclusions; and 4) changed circumstances.

1.2 Proposed Action

The proposed action considered in this EIS is:

- The issuance of ITAs, by NMFS, for the incidental taking of marine mammals during G&G permitted activities, ancillary activities, and exploratory drilling activities in the U.S. Beaufort and Chukchi Seas, Alaska, under Section 101(a)(5) of the MMPA, and
- The authorization of G&G and ancillary activities in the U.S. Beaufort and Chukchi Seas, Alaska, by BOEMRE under the OCS Lands Act.

BOEMRE plans to incorporate by reference the content of this EIS into future NEPA and other environmental analyses for site-specific exploratory drilling. BOEMRE performs NEPA compliance review for exploratory drilling activities for every Exploration Plan to issue permits for on-lease exploration operations.

1.3 Purpose and Need for Action

Purpose
Under the MMPA, the 'taking' of marine mammals, incidental or otherwise, without a permit or exemption is prohibited, with a few exceptions. One such exception (as stated in Sections 101(a)(5)(A) and (D)) is for the incidental, but not intentional, "taking," by U.S. citizens, while engaging in an activity (other than commercial fishing) of small numbers of marine mammals of a species or population stock provided that the taking will have a negligible impact on such species or stock, will not have an unmitigable

adverse impact on the availability of such species or stock for taking for subsistence uses, and the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting are set forth. Additionally, pursuant to Section 101(a)(5)(D) of the MMPA monitoring plans are required to be independently peer reviewed where the proposed activity may affect the availability of a species or stock for taking for subsistence uses.

The term "take" under the MMPA means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA further defines "harassment" as "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment]."

ITAs issued by the Secretary of Commerce, pursuant to Section 101(a)(5) of the MMPA, as indicated above, provide the exemption to the take prohibition in the MMPA and ensure compliance with the MMPA and NMFS' implementing regulations. Therefore, NMFS and BOEMRE have, through this Draft EIS, analyzed the environmental impacts associated with authorizing the take of marine mammals incidental to oil and gas exploration activities in the U.S. Beaufort and Chukchi Seas, Alaska, using the best available science and including impacts to marine mammals and the subsistence uses of these species. The analysis considers the effects associated with issuing ITAs for oil and gas activities such as seismic surveys, exploratory drilling activities, aircraft and support vessel activity (including, for example, icebreaking and resupply). This EIS also includes an analysis of the environmental impacts associated with authorizing seismic surveys under the OCS Lands Act.

ITAs may be issued as either (1) regulations and associated Letters of Authorization (LOAs) or (2) Incidental Harassment Authorizations (IHAs). An IHA can only be issued if the proposed action will not result in a potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures. Where the proposed activity has the potential to result in serious injury and/or mortality, only regulations and associated LOAs may be used to authorize take. However, regulations and LOAs may also be issued when there is no potential for serious injury and/or mortality if the applicant requests it, which applicants sometimes do for multi-year activities because it offers some administrative streamlining benefits. The Secretary of Commerce is required to authorize the take of small numbers of marine mammals incidental to a specified activity if the taking would have no more than a "negligible impact" on marine mammal species or stocks and not have an "unmitigable adverse impact" on the availability of such species or stocks for taking for subsistence uses.

The OCS Lands Act directs the BOEMRE to oversee the "expeditious and orderly development" of OCS resources subject to environmental safeguards (43 U.S.C. §§ 1332(3), (6), 1334(a)(7)). Critical to the potential development of OCS resources is the ability to gather geological and geophysical data on the resource potential of the OCS.

Pursuant to 30 CFR § 251.4, a G&G permit must be obtained from BOEMRE to conduct G&G exploration for oil, gas, and sulphur resources when operations occur on unleased lands or on lands leased to a third party. Separate permits must be obtained for other G&G explorations for mineral resources (30 CFR Part 280). Ancillary activities are regulated under 30 CFR Part 250, which states that a notice must be submitted before conducting G&G data collection pursuant to a lease issued or maintained under the OCS Lands Act (30 CFR § 250.208).

Need

NMFS anticipates receipt of applications to take marine mammals incidental to oil and gas industry exploration activities (i.e., G&G and ancillary surveys and exploratory drilling) pursuant to Sections 101(a)(5)(A) and (D) of the MMPA. This EIS is intended to assist NMFS in its MMPA decision-making process related to projected requests for ITAs in the U.S Beaufort and Chukchi Seas for future years and may be revised as necessary.

BOEMRE anticipates receipt of applications to conduct exploration surveys pursuant to the OCS Lands Act. The EIS may be used by BOEMRE to analyze the environmental impacts for the approval of G&G permitted activities, based on a case-by-case evaluation, or it may serve as a tiering document (as contemplated by the CEQ regulations) for future, site-specific oil and gas activities, where it is determined that further NEPA analysis may be required. To fulfill BOEMRE statutory mandates for proposed exploratory drilling projects, BOEMRE requires the collection of high-resolution shallow hazards data to: (a) ensure safe operations, which refers to detection of shallow gas pockets, faults, channel boundaries or other geological or man-made features that could be hazards to drilling; (b) support environmental impact analyses; (c) protect resources through avoidance measures, such as prohibiting anchor locations within a boulder patch area or a potential archeological site; and (d) perform other statutory responsibilities.

1.4 Scope and Objectives

The scope of the proposed action involves two parts: (1) to continue permitting or authorizing exploration activities that will provide the oil and gas industry and BOEMRE with the best available data on the location, extent, and properties of hydrocarbon resources, as well as information on shallow geological hazards and seafloor geotechnical properties; and (2) to support MMPA authorizations for the take of marine mammals incidental to conducting deep penetration seismic surveys, shallow hazards surveys, and exploratory drilling activities under the Proposed Action. Therefore, the objectives of the EIS are to:

1. Evaluate a broad range of reasonably foreseeable levels of exploration activities (e.g., deep penetration seismic surveys, shallow hazards surveys, and exploratory drilling activities), including the use of alternative technologies and methodologies intended to reduce the amount and/or intensity of sound output, in state and federal waters in the U.S. Beaufort and Chukchi Seas. The EIS may be used, based on a case-by-case evaluation, as the sole NEPA compliance document for future NMFS and BOEMRE actions covered by this EIS, or it may serve as a tiering document (as

contemplated by the CEQ regulations) where it is determined that further NEPA analysis may be required.

2. Provide environmental information that can be used to help NMFS evaluate whether to issue ITAs under the MMPA for activities in state and federal waters in the U.S. Beaufort and Chukchi Seas and to help BOEMRE evaluate whether to grant G&G permits or other authorizations under the OCS Lands Act for proposed activities.

3. Project the amount and extent of OCS and state water G&G, ancillary, and exploratory drilling activities that are likely to occur in the U.S. Chukchi and Beaufort Seas based on the best available information.

4. Identify and analyze any direct, indirect, and cumulative impacts that may result from the proposed action, including the benefits of one or more measures to mitigate adverse environmental effects.

5. Evaluate a range of monitoring and mitigation measures that might be implemented relative to the level of deep penetration geophysical surveys, shallow hazards surveys, and exploratory drilling to minimize impacts to marine resources and subsistence users.

The analyses contained in this EIS provide decision-makers and the public with an evaluation of the potential environmental, social, and economic effects of a range of reasonable alternatives, including the proposed action. The EIS also includes an analysis of the potential cumulative impacts of the proposed action, particularly as they relate to marine resources (e.g., marine mammals, fish, etc.) and subsistence harvest activities.

Specifically, NMFS and BOEMRE have, through this draft EIS:

- Described the Proposed Action and a range of reasonable alternatives, including a suite of proposed mitigation measures, as well as consideration of other mitigation measures;
- Assessed the direct and indirect effects of the Proposed Action and alternative approaches to authorize oil and gas deep penetration geophysical surveys and shallow hazards surveys under the OCS Lands Act and the taking of marine mammals incidental to seismic surveys and exploratory drilling activities under the MMPA;
- Assessed the effects on the marine mammal species and the availability of those species for subsistence uses, as well as other components of the marine ecosystem and human environment;
- Assessed the cumulative impacts associated with the Proposed Action; and
- Analyzed the effects of obtaining geotechnical data for pre-feasibility analyses of shallow sub-sea sediments associated with identifying potential shallow geophysical hazards, as part of proposed exploratory drilling.

NMFS will use the EIS to support the consideration of future MMPA authorizations for deep penetration geophysical surveys, shallow hazards surveys, and exploratory drilling activities in state and federal waters in the U.S. Beaufort and Chukchi Seas. There are multiple regulatory scenarios under which NMFS can issue MMPA authorizations (e.g., IHA versus LOA, or the structure of the Open Water Meeting or Monitoring peer review). The history and known strengths and challenges of the various scenarios will be discussed in Chapter 5. The EIS will assist BOEMRE in the analysis needed to ensure safe operations, meet regulatory requirements, and protect benthic habitat in federal waters.

Comment [HS4]: Just protection of benthic habitat?

1.5 Issues and Concerns to be Addressed in the EIS

The NOI to prepare the EIS (75 FR 6175, February 8, 2010) provided a list of issues on which NMFS was seeking public input. These issues included:

- Protection of subsistence resources and Inupiat culture and way of life;
- Disturbance to bowhead whale migration patterns;
- Impacts of seismic operations on marine fish reproduction, growth, and development;
- Harassment and potential harm of wildlife, including marine mammals and marine birds, by vessel operations, movements, and noise;
- Impacts on water quality;
- Changes in the socioeconomic environment;
- Impacts to threatened and endangered species;
- Impacts to marine mammals, including disturbance and changes in behavior;
- Incorporation of traditional knowledge in the decision-making process; and
- Effectiveness and feasibility of marine mammal monitoring and other mitigation and monitoring measures.

The scoping period for the *Effects of Oil and Gas Activities in the Arctic Ocean Draft EIS* began on February 8, 2010 and ended April 9, 2010. Public scoping meetings were held during February and March 2010 in the communities of Kotzebue, Point Hope, Point Lay, Wainwright, Barrow, Nuiqsut, Kaktovik, and Anchorage. Scoping comments were received verbally and in writing through discussion, testimony, fax, regular mail, and electronic mail.

Of the issues identified during scoping, those that were most commonly raised included:

- Concerns regarding the NEPA process;
- Impacts to marine mammals and habitats;
- Risks of oil spills;
- Climate change;
- Protection of subsistence resources and the Inupiat culture and way of life;
- Availability of research and monitoring data for decision-making;
- Monitoring requirements; and
- Suggestions for, or implementation of, mitigation measures.

For more detail on the issues raised during the scoping process, please refer to Appendix XX of the EIS.

Issues and concerns associated with oil and gas related activities in the marine environment have also been documented for decades by the scientific community, in government publications, at scientific symposia, and through scoping and public meetings/comments, and other NMFS and BOEMRE NEPA analyses. In addition, public testimony and Traditional Knowledge from Alaska Natives have provided valuable information about seismic survey operations and exploratory drilling activities. Where appropriate, NMFS and BOEMRE will address this information in the relevant sections of the EIS.

1.6 Description of the Project Area

The project area for this EIS, illustrated in Figure XX, covers a total area of approximately XX million acres within the Alaskan portion of the Chukchi and Beaufort Seas. It includes state and OCS waters adjacent to the North Slope of Alaska, and transit areas of the Chukchi Sea north of the Bering Straits. The oceanographic area extends from Kotzebue on the west to the U.S.-Canada border on the east. The offshore boundary is the BOEMRE Beaufort Sea and Chukchi Sea Planning Areas, approximately 322 km (200 mi) offshore. Onshore locations included within the project area include communities of the North Slope: Kotzebue, Point Hope, Point Lay, Wainwright, Barrow, Nuiqsut, and Kaktovik, and the Prudhoe Bay area. Other onshore locations considered part of the project area are identified in Figure XX, and are typically identified as important biological areas such as known haul out locations.

1.7 Recent Chronology of NEPA Activities and Documents that Influence the Scope of the EIS

The effects of oil and gas related deep penetration geophysical surveys, shallow hazard surveys, and exploratory drilling activities in the U.S. Beaufort and Chukchi seas have been evaluated to some degree in previous NEPA documents produced by both the NMFS and MMS. Summaries of these documents are contained herein. Portions of these NEPA documents are appropriately incorporated by reference, as directed by 40 CFR 1502.21 of the CEQ's regulations.

- In 2003, MMS prepared the ***Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, 202 Final Environmental Impact Statement (OCS EIS/EA MMS 2003-001)***. The Final EIS analyzed the environmental effects of these three sales – Sale 186 in 2003, Sale 195 in 2005 and Sale 202 in 2007 – all of which consider leasing the same geographical area in the Beaufort Sea.

- In 2006, MMS prepared **Draft and Final Programmatic Environmental Assessments (PEAs) on the *Arctic Ocean Outer Continental Shelf Seismic Surveys - 2006*** (MMS, 2006, or PEA) for permitting up to four seismic surveys to

be conducted in the open water season in both the Beaufort and Chukchi Seas, for a total of up to eight annual surveys. NMFS was a cooperating agency in the preparation of the MMS PEA. A Final PEA was released by MMS on June 22, 2006 and adopted by NMFS.

- On November 17, 2006, NMFS and MMS issued a NOI to jointly prepare a **Programmatic EIS (PEIS) for *Seismic Surveys in the Chukchi and Beaufort Seas, Alaska*.** The PEIS assessed the impacts of MMS' six annual authorizations under the OCS Lands Act to the U.S. oil and gas industry, to conduct a higher level of offshore geophysical seismic surveys in the Chukchi and Beaufort Seas off Alaska over a longer time frame than evaluated in the PEA, and to assess the impacts of NMFS' authorizations under the MMPA to incidentally harass marine mammals while conducting those surveys. The Draft PEIS assumed that up to six offshore geophysical seismic surveys would be conducted annually in both the Chukchi and Beaufort Seas off Alaska (for a total of up to 12 annual surveys) and evaluated the environmental effects of the increased level of seismic effort (which represents a 50 percent increase in activity compared to the level of seismic effort analyzed in the MMS 2006 PEA). On March 30, 2007, the Environmental Protection Agency announced the availability for comment of the MMS/NMFS Draft PEIS (MMS, 2007a). However, on October 28, 2009, NMFS published a notice of withdrawal of the 2007 PEIS (74 FR 55539).

- In May 2007, MMS issued the **Final EIS for the *Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activity in the Chukchi Sea*** and also examined a proposal for exploration seismic survey permitting in 2007 in the proposed sale area and two alternatives for the 2007 seismic surveys (OCS EIS/EA MMS 2007-026).

Comment [HS5]: Also consider the supplemental DEIS and BOEMRE's recent decision to do additional analysis to evaluate large spill scenarios?

- In August 2007, NMFS prepared a **Supplemental EA** (SEA; NMFS, 2007a) and issued a new Finding of No Significant Impact (FONSI) to update the 2006 Final PEA for analysis of an **Arctic seismic survey ITA**, including NMFS' issuance of an IHA to Shell Offshore Inc. (Shell) for the 2007 season. The 2007 SEA analyzed the effects on the human environment of issuing an IHA to Shell for the take of marine mammals incidental to conducting deep penetration 3D seismic surveys in both the Beaufort and Chukchi seas and marine surveys, including site clearance and shallow hazards surveys, in the Beaufort Sea during the 2007 Arctic open-water season. Where appropriate, sections of the 2006 Final PEA and 2007 Draft PEIS were incorporated into the 2007 SEA by reference.

- In October 2007, NMFS prepared an **EA for the issuance of an IHA to Shell** to take marine mammals incidental to conducting an offshore drilling project in the U.S. Beaufort Sea (NMFS, 2007b) and issued a FONSI on October 24, 2007. This EA analyzed the effects on the human environment of issuing an IHA to Shell for the take of marine mammals incidental to conducting open-water offshore exploratory drilling in OCS blocks of the U.S. Beaufort Sea.

- For the 2008 Arctic open-water season, NMFS received applications from five oil and gas companies requesting IHAs to conduct various types of seismic and site clearance and shallow hazards surveys in the Arctic Ocean. In July 2008, NMFS prepared a new **seismic/site clearance survey SEA** (2008 SEA; NMFS, 2008) to update analyses contained in the 2006 Final PEA since it was determined that the 2008 surveys would have environmental impacts similar to the activities analyzed in the 2006 Final PEA. Where appropriate, sections of the 2006 Final PEA and 2007 Draft PEIS, as well as NMFS' 2007 SEA, Arctic Regional Biological Opinion, MMS' 2007 *Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activities in the Chukchi Sea - Final Environmental Impact Statement* (MMS, 2007b), and MMS' *Beaufort Sea Planning Area Oil and Gas Lease Sales 186, 195, 202 Final Environmental Impact Statement* (MMS, 2003), were incorporated into the 2008 SEA by reference. After completion of the 2008 SEA, NMFS issued five FONSIs in July and August 2008 for each of the five IHAs issued by NMFS.

- In November 2008, MMS published a **Draft EIS for the *Beaufort and Chukchi Sea Planning Areas Oil and Gas Lease Sales 209, 212, 217, and 221*** (*Arctic Multiple Sale Draft EIS*). This Draft EIS evaluated several alternatives for leasing (lease block configurations) and the direct and indirect effects to the human, physical, and biological resources from activities associated with exploration, development, and production scenarios, as well as accidental oil spills. The cumulative-effects analysis evaluated the environmental effects of the proposed action and alternatives with past, present, and reasonably foreseeable future actions occurring in these regions. The Secretary of the Interior cancelled these lease sales for further consideration in the Preliminary Revised Program for the 2007-2012 Five Year Oil and Gas Leasing Program on March 31, 2010. Therefore, BOEMRE will not prepare a Final EIS for these lease sales.

- In August 2009, NMFS published an **EA for the issuance of an IHA to Shell**, which analyzed the impacts to the human environment that may result from the take of marine mammals incidental to conducting an open water marine survey program in the Chukchi Sea, Alaska, during 2009. Portions of several of the NEPA documents mentioned above were incorporated by reference into the 2009 EA. Among other things, the 2009 EA updated information on the potential impacts to marine mammals based on previous years of monitoring. NMFS issued a FONSI on August 14, 2009.

- In October 2009, MMS published an **EA for the Shell *2010 Exploration Drilling Program-Camden Bay, Beaufort Sea, Alaska* (OCS EIS/EA MMS 2009-052),** which analyzed the environmental impacts of exploration drilling. Shell proposed to drill two exploration wells during the July-October 2010 open-water-drilling season. The EA tiered from existing environmental documents and incorporated by reference other environmental documents (see EA page 2-3 for the list of environmental documents).

- In December 2009, MMS published an **EA for the Shell *2010 Exploration Drilling Program—Burger, Crackerjack, and Southwest Shoebill Prospects in the Chukchi Sea Outer Continental Shelf, Alaska* (OCS EIS/EA MMS 2009-061)**. Shell proposed to drill exploration wells at up to three of five possible drill sites during the July-October 2010 open-water-drilling season. The EA tiered from existing environmental documents and incorporated by reference other environmental documents (see EA page 6-7 for the list of environmental documents).

- In June 2010, BOEMRE published an **EA for Statoil's *Proposed Seismic Survey Activity in the Chukchi Sea Planning Area* (OCS EIS/EA BOEMRE 2010-020)**. The EA tiered from two previous environmental documents: (1) Final PEA, Arctic Ocean Outer Continental Shelf, Seismic Surveys—2006 (OCS EIS/EA MMS 2006-038) June 2006; and (2) Final EIS, Chukchi Sea Planning Area, Oil and Gas Lease Sale 193 EIS and Seismic Surveying Activities in the Chukchi Sea (OCS EIS/EA MMS 2007-026) May 2007.

- In July 2010, BOEMRE published an **EA for Shell *Exploration & Production Proposed Ancillary Activities—Marine Surveys in the Beaufort Sea, Alaska* (OCS EIS/EA MMS 2010-022)**. Ancillary activities are activities conducted by a leaseholder on BOEMRE-issued leases for the purposes of obtaining data and information to develop an Exploration Plan or Development and Production Plan. Shell proposed shallow hazard and site clearance surveys, ice gouge surveys, strudel scour surveys, marine baseline studies, and seafloor soil sampling. The EA tiered from existing environmental documents and incorporated by reference other environmental documents (see EA page 2-3 for the list of environmental documents).

- In July 2010, NMFS prepared an EA for the issuance of IHAs to take marine mammals incidental to conducting open-water seismic and marine survey programs in the U.S. Chukchi and Beaufort Seas (NMFS, 2010). This EA analyzed the impacts to the human environment from the issuance of an IHA to Shell for the take of marine mammals incidental to conducting an open-water marine survey program in the U.S. Chukchi and Beaufort Seas and the issuance of an IHA to Statoil for the take of marine mammals incidental to conducting 3D and 2D open-water seismic surveys in the Chukchi Sea. Several of the earlier NEPA documents mentioned in this list were incorporated into NMFS' 2010 EA by reference. After completion of the EA, NMFS issued two FONSIs for each of the IHAs issued by NMFS.

- In September 2010, BOEMRE issued an **EA for ION's *Geological and Geophysical Surveys* (OCS EIS/EA BOEMRE 2010-027).** The EA analyzed the environmental impacts associated with an airgun array and echosounders operated during 2D seismic survey, as well as potential impacts from icebreaking during the survey. The survey in the U.S. Beaufort and Chukchi Seas would extend from the U.S.-Canada border in the east to Point Barrow in the west. The EA

incorporated by reference past NEPA documents that provided a comprehensive characterization of the Arctic Ocean's physical, biological, and socio-economic resources and Alaska Native subsistence activities, and evaluated a broad spectrum of potential seismic survey-related impacts (see EA page 2 for the list of these documents).

1.8 Federal Laws and Other Requirements Applicable to Oil and Gas Activities in the Arctic Ocean

Comment [JCurtis6]: At a minimum, please consider CWA, CAA, etc., as well as state and local requirements.

The Federal issuance of permits and authorizations under the OCS Lands Act in the U.S. Chukchi and Beaufort Seas off the coast of Alaska and NMFS' authorizations under the MMPA are subject to a number of Federal laws and regulations and Executive Orders. These are briefly summarized below.

National Environmental Policy Act of 1969
NEPA establishes a nationwide policy and goal of environmental protection, and provides legal authority for Federal agencies to carry out that policy (40 CFR 1500.1(a)). It requires Federal agencies to study and consider the environmental consequences of their actions and to use an interdisciplinary framework for environmental decision-making, which includes the consideration of environmental amenities and values (42 U.S.C. §4332(B)).

NEPA also requires Federal agencies to make environmental information available to the public and to public officials and to consider their comments before making decisions that could affect the environment. Documents prepared by Federal agencies in compliance with NEPA must be streamlined to focus on the issues that are truly significant to the action in question and present alternatives in a way that allows potential environmental consequences to be clearly distinguished, along with "advice and information useful in restoring, maintaining, and enhancing the quality of the environment" (43 FR 55990, November 28, 1978, and 40 CFR 1502.1, 1502.2, and 1502.14).

The provisions of NEPA require that an EIS contain the following elements:

1. Statement of Purpose and Need for the Proposed Action;
2. Description of Alternatives Evaluated in the EIS, including the Proposed Action, the No Action Alternative, and Alternatives Evaluated but Eliminated from Further Consideration;
3. Description of the Affected Environment;
4. Analysis of Environmental Consequences of Alternatives Carried Forward in the EIS;
5. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity; and
6. Any Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action Should it be Implemented.

The preparation of an EIS must include the following five basic steps:

1. **Scoping.** As the first step in the NEPA process, scoping provides an opportunity for the public, government agencies, and other interested groups to provide information and advice on issues that might be associated with the proposed project, so that the lead Federal agency can decide whether and how to address them in the EIS. Scoping can also identify new alternatives to be considered in the EIS.
2. **Draft Environmental Impact Statement (DEIS).** After scoping is completed, a DEIS is prepared. The DEIS describes and evaluates a range of reasonable alternative actions, including no action. If the lead agency has decided upon a preferred alternative by the time a DEIS is prepared, it is identified. The DEIS evaluates physical, biological, socioeconomic, and environmental impacts that might result from the alternatives carried forward for analysis, and it describes the significance of environmental effects surrounding the various alternatives, including the proposed action. Finally, it identifies ways to mitigate the potential impacts – to avoid, minimize, rectify, reduce, or eliminate those impacts over time or to compensate for any potential harm to the environment that might be caused by any of the alternatives.
3. **Public Comment on the DEIS.** Following publication of a DEIS, a public NOA for review is published in the FR, which begins a public comment period of no less than 45 days. A public hearing may be conducted to provide an opportunity for interested parties to provide oral comments on the DEIS. Following the public comment period, the lead agency considers all of the comments received and prepares a final EIS (FEIS) and includes responses to the comments on the DEIS.
4. **Final Environmental Impact Statement (FEIS).** The FEIS must identify the lead agency's preferred alternative (unless another law prohibits the expression of such a preference) and may identify the environmentally preferable alternative, which may be different. Once the FEIS is completed and published, there is a 30-day "wait" period before an agency may issue its Record of Decision (ROD) (see below).
5. **Record of Decision.** Following completion of the FEIS process as described above, the lead agency prepares a ROD. The ROD must: (1) state what the decision was; (2) identify all alternatives considered in reaching the decision and which were considered to be environmentally preferable; and (3) state whether all practicable means to avoid or minimize environmental harm have been adopted, and if not, why not (40 CFR 1505.2). If a monitoring and enforcement program is applicable for any mitigation, it must be adopted and summarized in the ROD (40 CFR 1505.2).

National Oceanic and Atmospheric Administration Administrative Order (NAO) 216-6

NAO 216-6 describes NOAA's policies, requirements, and procedures for complying with NEPA and the implementing regulations issued by CEQ as codified in Parts 1500-

1508 of Title 40 of the CFR (40 CFR Parts 1500-1508) and those issued by the DOC in Department Administrative Order (DAO) 216-6, *Implementing the NEPA.* NAO 216-6 incorporates the requirements of Executive Order (EO) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations. Also, the Order reiterates provisions to EO 12114, Environmental Effects Abroad of Major Federal Actions, as implemented by DOC in DAO 216-12, Environmental Effects Abroad of Major Federal Actions (NAO 216-6).

Endangered Species Act

NMFS and BOEMRE have shared mandates under the Endangered Species Act (ESA). Section 7 (16 U.S.C. §1536) of the ESA states that all Federal agencies shall, in consultation with, and with the assistance of the Secretary of the Interior or Commerce (Secretary), ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species, which is determined by the Secretary to be critical. Section 9 (16 U.S.C. §1538) of the ESA identifies prohibited acts related to endangered species and prohibits all persons, including all Federal, state and local governments, from taking listed species of fish and wildlife, except as specified under provisions for exemption (16 U.S.C. §§1535(g)(2) and 1539). Generally, the USFWS manages land and freshwater species while NMFS manages marine species, including anadromous salmon. However, the USFWS has responsibility for some marine animals such as nesting sea turtles, walruses, polar bears, sea otters, and manatees.

For actions that may result in prohibited "take" of a listed species, Federal agencies must obtain authorization for incidental take through Section 7 of the ESA's formal consultation process. Under the ESA, "take" means to "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt any such conduct to species listed as threatened or endangered in 50 CFR 402.12(b)." NMFS has further defined harm as follows: "harm" is "…an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation which actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including, breeding, spawning, rearing, migrating, feeding or sheltering" (50 CFR 222.102). NMFS has not defined the term "harass".

Under Section 7 of the ESA, Federal agencies consult with the USFWS and/or NMFS and submit a consultation package for proposed actions that may affect listed species or critical habitat. If a listed species or critical habitat is likely to be affected by a proposed Federal action, the Federal agency must provide the USFWS and NMFS with an evaluation whether or not the effect on the listed species or critical habitat is likely to be adverse. The USFWS and/or NMFS uses this documentation along with any other available information to determine if a formal consultation or a conference is necessary for actions likely to result in adverse effects to a listed species or its designated critical habitat. If a Federal action is likely to adversely affect endangered or threatened species or designated critical habitat, then USFWS and/or NMFS prepares a Biological Opinion, which makes a determination as to whether the action is likely to jeopardize an

endangered or threatened species. If take is anticipated, the USFWS and/or NMFS must also issue an Incidental Take Statement, which includes terms and conditions and reasonable and prudent measures which must be followed.

Marine Mammal Protection Act

Under the MMPA (16 U.S.C. § 1361 *et seq.*), the taking of marine mammals without a permit or exemption is prohibited. The term, "take" under the MMPA, means "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." The MMPA defines "harassment" as "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

In order to obtain an exemption from the MMPA's prohibition on taking marine mammals, a citizen of the U.S. who engages in a specified activity (other than commercial fishing) within a specified geographic region must obtain an ITA under section 101(a)(5)(A) or (D) of the MMPA. An ITA shall be granted if NMFS finds that the taking of small numbers of marine mammals of a species or stock by such citizen will have a negligible impact on the affected species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses. NMFS shall also prescribe, where applicable, the permissible methods of taking and other means of affecting the least practicable impact on the species or stock and its habitat (i.e., mitigation, monitoring and reporting of such takings). ITAs may be issued as either (1) regulations and associated LOAs or (2) IHAs. IHAs can be issued only when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures.

As part of the MMPA authorization process, applicants are required to provide detailed mitigation plans that outline what efforts will be taken to reduce negative impacts to marine mammals, and their availability for subsistence use, to the lowest level practicable. In addition, MMPA authorizations require that operators conduct monitoring, which must be designed to result in an increased knowledge of the species and an understanding of the level and type of takings that result from the authorized activities. Where the proposed activity may affect the availability of a species or stock of marine mammal for taking for subsistence uses, the proposed monitoring plan must be independently peer reviewed pursuant to 16 U.S.C. § 1371(a)(5)(D), prior to issuance of the ITA.

Outer Continental Shelf Lands Act

The OCS Lands Act of 1953 (67 Stat. 462), as amended (43 U.S.C. §1331 *et seq*. [2006]), established Federal jurisdiction over submerged lands on the OCS, seaward of State boundaries. Under the OCS Lands Act, the USDOI is required to manage the leasing, exploration, development, and production of mineral resources on the Federal OCS. The OCS Lands Act established that OCS development proceed in a safe and efficient manner that provides for environmental protection, fair and equitable returns to the public, State

and local participation in policy and planning decisions, and resolution of conflicts related to other ocean and coastal resources and uses. In 1978, Congress amended the OCS Lands Act, 43 U.S.C. §§ 1331-1356a, 1801-1802, to provide for the "expedited exploration and development of the [OCS]," in a manner that balances the need "to make such resources available to meet the Nation's energy needs as rapidly as possible… with protection of the human, marine, and coastal environments."

Magnuson-Stevens Fishery Conservation and Management Act
Federal agencies are required to consult with the Secretary of Commerce with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken, by such agency that may adversely affect essential fish habitat (EFH) identified under the Magnuson Stevens Fishery Conservation and Management Act (MSFCMA).

Coastal Zone Management Act
The Coastal Zone Management Act (CZMA) encourages coastal states to develop comprehensive programs to manage and balance competing uses of and impacts to coastal resources. The CZMA emphasizes the primacy of state decision-making regarding the coastal zone. Section 307 of the CZMA (16 U.S.C. § 1456), called the Federal consistency provision, is a major incentive for states to join the national coastal management program and is a powerful tool that states use to manage coastal uses and resources and to facilitate cooperation and coordination with Federal agencies.
Federal consistency is the CZMA requirement where Federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone (also referred to as coastal uses or resources and coastal effects) must be consistent to the maximum extent practicable with the enforceable policies of a coastal state's Federally-approved coastal management program.

Executive Order 12898: Environmental Justice
EO 12898, signed by the President on February 11, 1994, and published February 16, 1994 (59 FR 7629), requires that Federal agencies make achieving "environmental justice" part of their mission by identifying and addressing disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low income populations in the U.S. Many Alaska Natives harvest marine mammals for subsistence purposes and benefit from their continued existence. There is the potential for a disproportionately high level of impact and adverse human health or environmental effects on Alaska Natives in authorizing incidental takes. The effects of the Federal action on minority populations are described in Chapter 4.

Executive Order 13175: Consultation and Coordination with Indian Tribal Governments
This EO, signed by the President on November 6, 2000, and published on November 9, 2000 (65 FR 67249), is intended to establish regular and meaningful consultation and collaboration between Federal agencies and Native tribal governments in the development of Federal regulatory practices that significantly or uniquely affect their communities. In preparing this EIS, NMFS has initiated a government-to-government

consultation process with affected Federally-recognized tribal governments. On January 29, 2010, letters were sent from NMFS to Federally-recognized Alaska Native tribes within the project area, including the Native Village of Point Hope, the Native Village of Point Lay, the Inupiat Community of the Arctic Slope, the Native Village of Barrow, the Native Village of Kaktovik, the Native Village of Nuiqsut, and the Village of Wainwright Traditional Council, initiating government-to-government consultations and inviting those governments to participate in the EIS process. The letters provided some background information on the history of the project and the proposed action. The stated goal is to work collaboratively with Tribal Governments in the area of the U.S. Chukchi and Beaufort Seas in order to explore ways that the energy development in the Arctic can best co-exist with the subsistence culture and lifestyle. Both BOEMRE and NMFS value the contribution that Alaska Native knowledge and experience can provide with regard to understanding marine mammals and the environment in general.

Co-management Agreements

Through Section 119 of the MMPA, NMFS and the USFWS were granted authority to enter into cooperative agreements with Alaska Native Organizations (ANOs), including, but not limited to, Alaska Native Tribes and tribally authorized co-management bodies. Individual co-management agreements shall incorporate the spirit and intent of co-management through close cooperation and communication between federal agencies and the ANOs, hunters, and subsistence users. Agreements encourage the exchange of information regarding the conservation, management, and utilization of marine mammals in U.S. waters in and around Alaska.

Under Section 119 agreements, marine mammal stocks should not be permitted to diminish beyond the point at which they cease to fulfill their role in their ecosystem or to levels that won't allow for sustainable subsistence harvest. Agreements may involve: (1) developing marine mammal co-management structures and processes with federal and state agencies; (2) monitoring the harvest of marine mammals for subsistence use; (3) participating in marine mammal research; and (4) collecting and analyzing data on marine mammal populations.

NMFS currently has three co-management agreements with Native Alaskan groups specific to species found in the U.S. Beaufort and Chukchi Seas and which are relevant to the scope of this EIS. Those agreements are with the Alaska Beluga Whale Committee for Western Alaska beluga whales, with the Alaska Eskimo Whaling Commission for the Western Arctic stock of bowhead whales (also known as the Bering-Chukchi-Beaufort stock), and with the Ice Seal Committee for the Alaska stocks of ringed, bearded, spotted, and ribbon seals.

1.9 Organization of the Document

The format and content of this document was guided by the CEQ regulations and NOAA NEPA guidance. The draft EIS includes the following sections:

Executive Summary

1.0 Purpose and Need

- Summarizes the purpose and need for the Proposed Action, the major issues, background actions, pertinent laws and regulations, and the decisions to be made.

2.0 Proposed Action and Alternatives

- Describes and compares the Proposed Action and a range of reasonable alternatives.
- Lists alternatives considered but rejected from detailed analysis.
- Describes project activities that will be considered, as well as potential mitigation measures to be applied.

3.0 Affected Environment

- Describes the current condition of relevant resources in the project area and establishes the baseline for comparing the predicted effects of the alternatives.

4.0 Environmental Consequences

- Analytically predicts and compares the consequences to relevant resources from implementing each alternative.
- The predictions include the direct, indirect, and cumulative effects of each alternative.

5.0 NEPA Compliance Implementation and Recommendations

- Outlines how NMFS will implement the EIS procedurally, including descriptions of adaptive management components and additional mitigation measures that could be utilized.

6.0 Consultation and Coordination

- Documents scoping, meetings, compliance with consultation requirements, and preparers of the EIS.

7.0 References

- Lists the documents and other sources used to prepare the EIS.

Glossary

- Contains useful definitions of terms found in the EIS.

Index

- Provides a list of key terms and subjects discussed in the EIS and includes page numbers of where they are referred to in the text.

Appendices

- Includes important documents concerning the Proposed Action, public involvement, and consultation and coordination activities.